Cuda 12000 IP Access Switch Installation Guide

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Remote technical assistance will be provided free of charge during the 60-day software warranty period. The hours for support during the warranty period are Monday through Friday from 8:00am to 5:00pm EST.

Additional hardware and software services are available by purchasing an extended service agreement. Contact your account representative or call 1-877-227-9783 for further details.

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E GLOSSARY

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ABOUT THIS GUIDE

This chapter introduces you to the *Cuda 12000 IP Access Switch Installation Guide* and contains:

- Document Objective
- Audience
- Document Organization
- Notations
- Related Documentation
- Contacting ADC Customer Support

Document Objective

This guide provides information on how to install and power on the Cuda 12000.

Audience

This guide is intended for a network administrator who is responsible for installing the Cuda 12000 within a cable television head-end site. It assumes a working knowledge of network operations, although it does not assume prior knowledge of ADC's network equipment.

Document Organization

The *Cuda 12000 IP Access Switch Installation Guide* is organized as follows:

- **Chapter 1: Hardware Overview** — Provides a physical and functional overview of the Cuda 12000 and system components.
- **Chapter 2: Preparing for Installation** — Describes site requirements, safety information and other considerations that you should be aware of before installing the system.
- **Chapter 3: Rack-Mounting the System** — Provides step-by-step procedures for rack-mounting the chassis and related system components.
- **Chapter 4: Installing Modules** — Provides information and procedures on how to install and replace system modules.
- **Chapter 5: Cabling the System** — Provides step-by-step procedures for cabling system components and power sources.
- **Chapter 6: Powering On and Powering Off** — Provides information on system initialization processes and includes explanations of status messages and LED activity upon boot up.
- **Appendix A: Configuring Network Access** — Contains information on getting started using the Cuda 12000.
- **Appendix B: System Specifications and Compliance** — Contains information on Cuda 12000 hardware specifications and compliance.
- **Appendix C: Martek Power Supply**— Contains an explanation of the front panel LEDs for the optional Martek Power Supply and some basic troubleshooting techniques.
- **Appendix D: Wiring Diagrams** — Contains pin-outs for serial access cabling and fault reporting cabling.
- **Appendix E: Glossary** — Provides a list of terms with definitions.

Notations

This table lists the text notations that are used throughout the Cuda 12000 documentation set.

Icon	Notice Type	Description
	Information Note	Important or useful information, such as features or instructions
	Caution	Information that alerts you to potential damage to the system
	Warning	Information that alerts you to potential personal injury

Conventions Used in This Guide

- Text formatted in *italics* indicates information that provides important tips or warnings.
- A description of each numbered callout in the module graphics, excluding the Management module, can be found in Table 1-2 on page 26.

Related Documentation

For more information on the Cuda 12000, see these publications:

- ***Cuda 12000 IP Access Switch CudaView Administration Guide*** — A procedural guide containing all the information that you need to configure the system using the graphical user interface (GUI).
- ***Cuda 12000 IP Access Switch CLI-based Administration Guide*** — A procedural guide containing all the information that you need to configure the system using the command line interface (CLI).
- ***Cuda 12000 IP Access Switch CLI Reference Guide*** — A reference guide containing all the information about the commands used to configure and manage the Cuda 12000 using the command line interface (CLI).

Contacting ADC Customer Support

To help you resolve any issues that you may encounter when installing, maintaining, and operating the Cuda 12000, you can reach ADC Customer Support as follows:

- Phone: (877) 227-9783 (option 4)
- E-mail: support@basystems.com
- Customer Support Web Site — To access ADC Customer Support on the Web, go to `http://www.adc.com/cable/support` then select the *Technical Assistance Center* link. You can then report the problem online, search the ADC Customer Support database for known problems and solutions, and check *Frequently Asked Questions*.

When contacting ADC for technical assistance, be sure to have this information ready:

- List of system hardware and software components, including revision levels and serial numbers.
- Diagnostic error messages.
- Details about recent system configuration changes, if applicable.

1 HARDWARE OVERVIEW

This chapter contains an overview of the Cuda 12000 hardware. The physical and functional descriptions of the Cuda 12000 hardware components and related features are illustrated. The following sections are included:

- Key Features
- System Overview
- Chassis
- Management Module
- Application Modules
- Fan Tray
- Plenums
- Ethernet Patch Panel

Key Features

The Cuda 12000 provides the following hardware:

Feature	Description
Total System Redundancy	The entire system is architected for full redundancy to provide a highly fault-tolerant solution that includes: ■ Dual-Power Sources: The system can be connected to two -48 VDC power sources to ensure uninterrupted power availability. ■ MeshFlow™ Fabric: Every application module is connected to every other application module via a high-speed serial mesh. This mesh supports a peak throughput capacity of 204.6 Gbps. (132 x 1.55 Gbps.)

Feature	Description
	■ Dual Management modules: The Cuda 12000 supports up to two Management modules to ensure uninterrupted system management. ■ Redundant Management Buses: The backplane consists of a 100-Mbps management BUS with redundant channels, over which the Management modules and system application modules communicate.
Distributed Processing Power	Application modules consist of a network processor with dedicated Synchronous Burst SRAM. Unlike other systems that use a central system processor, processing power and memory scale with every application module that you install in the chassis.
CableOnce™ Network Connections	The system supports a *CableOnce* design that allows you to cable directly to the appropriate connector fixed to the rear of the chassis, or slot backplate. Cabling directly to these stationary connectors, instead of to the modules themselves, allows module replacement without recabling. You remove a module and then insert a new one while the cables remain attached to the system. This blind-mate design also lets you pre-cable chassis slots to prepare them in advance for module installation at a later time.
Hot-swappable Modules	All system modules can be replaced while the system is running without interruption to other interconnected networks. Both application modules and Management modules are hot-swappable.

System Overview

The Cuda 12000 is intended for installation at your cable head-end site, or at your distribution hub, where it switches and routes IP traffic between your cable plant, IP backbone, and external networks.

The Cuda 12000 requires a -48 VDC power source for proper operation.

The Chassis and Modules

The Cuda 12000 offers a modular architecture that supports the following modules:

- Management Module
- DOCSIS Modules
  - 1x4 DOCSIS Module
  - 1x4 DOCSIS SpectraFlow Module
  - 1x6 DOCSIS SpectraFlow Module with Spectrum Management
- EuroDOCSIS Modules
  - 1x4 EuroDOCSIS Module
  - 1x4 EuroDOCSIS SpectraFlow Module
  - 1x4 EuroDOCSIS SpectraFlow Module with Spectrum Management
- Egress Modules
  - Octal 10/100 Ethernet SpectraFlow Module
  - Gigabit Ethernet SpectraFlow Module
  - Packet over SONET (POS) SpectraFlow Module
- Cuda Protocol Analyzer (CPA) Module - refer to the Cuda Protocol Analyzer User's Guide for more information.

DOCSIS (Data Over Cable Service Interface Specification) is a CableLabs® standard for inter operability with DOCSIS 1.0 and DOCSIS 1.1-based cable modems. EuroDOCSIS (European Data Over Cable Service Interface Specification) is a CableLabs® and tComLabs® standard.

DOCSIS and EuroDOCSIS modules serve as CMTS interface modules with your HFC network using upstream and downstream ports. Upstream ports

support both QPSK and 16 QAM modulation; the downstream port supports 64/256 QAM modulation. Each application module has an independent network processor and Synchronous Burst RAM. As a result, processing power and memory scale with every module that you install in the chassis.

DC-to-DC converters mounted on each module down-convert the -48 VDC power distribution and restrict power failures to a module level.

Routing Support

The route server module functions in a dual role as both a forwarding device and a route server. The configured route server is an egress (non-DOCSIS) module, such as an Octal 10/100 Ethernet SpectraFlow Module, Gigabit Ethernet SpectraFlow Module, or Packet over SONET (POS) SpectraFlow Module.

While maintaining its original role as a forwarding module, the route server maintains a central routing table. This module then distributes the routing table to other application modules upon initialization, and incrementally updates the forwarding tables as new routes are discovered. Distributed forwarding tables on each application module provide an added level of fault tolerance; should the Management module or another application module fail, the existing operational modules forward traffic without interruption.

A minimum system configuration includes:

- A single Management module.
- A DOCSIS or EuroDOCSIS module.
- An egress *(non-DOCSIS)* module*, such as 10/100 Ethernet SpectraFlow, Gigabit Ethernet SpectraFlow, or Packet over SONET (POS) SpectraFlow,* configured as a route server.

Backplane Connections

Each module slides into a chassis slot and connects directly to the backplane, where each gains connection to a redundant 100 Mbps management BUS, a high-speed serial mesh, redundant power BUSes, and various other components. The management BUS consists of dual 100 Mbps management channels over which the system Management modules and the application modules communicate.

The Cooling System

The cooling system for the Cuda 12000 is comprised of a fan tray augmented by plenums. The fan tray is comprised of three hot-swappable fan modules. Each fan module within the assembly consists of two five-inch fans. These six fans provide system cooling for a single chassis.

A fan tray is rack-mounted beneath each chassis in the rack and is designed to utilize plenums to ensure adequate air flow through the system. A plenum rack-mounted directly beneath each fan tray serves as the intake plenum to ensure adequate airflow into the system. Another plenum mounted above the chassis serves as the exhaust plenum to ensure proper airflow out of the system.

Each fan module in the assembly includes an LED on the front panel to indicate status. Green illumination indicates normal operation. If a fan should stop rotating or begin rotating too slowly, the LED illuminates red to indicate failure. In the event of a failure, the affected fan module can be replaced without interruption to the remaining units. A temperature sensor within the unit monitors the inlet airflow to ensure that the incoming air stream is not too warm. If the temperature of the incoming air stream exceeds acceptable limits, all three LEDs on the front of the fan tray illuminate red.

Power redundancy provides for two -48 VDC power connectors on the rear of the fan tray unit. Each fan module within the unit connects directly to a backplane where it gains connection to two DC voltage distribution channels.

Chassis

The Cuda 12000 is encased in a 15.75"H x 17.1"W x 15.9"D high-grade aluminum chassis. This section describes the front view, rear view, and interior view of a Cuda 12000 chassis.

Front View

The front of the Cuda 12000 chassis provides access for installation of up to twelve network application modules and two Management modules, as shown in Figure 1-1.

Slots on the front of the chassis are numbered from left to right. Dual circuit breakers in the lower-right corner of the chassis provide power-on controls for up to two separate power sources and overcurrent protection of 30 Amps. A single ESD grounding jack located on the circuit breaker panel provides convenient connection to an ESD wrist strap.

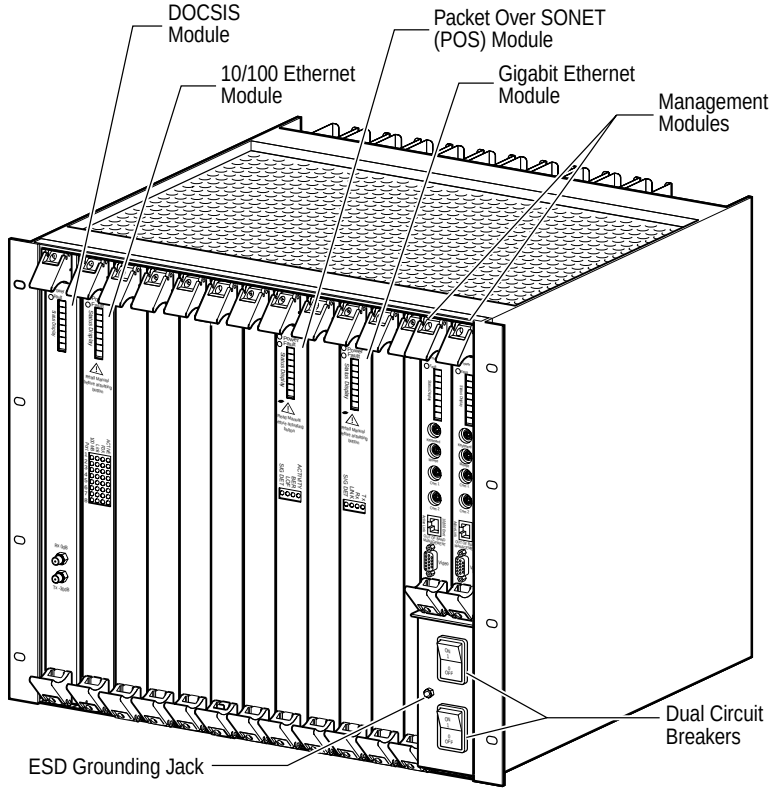


Figure 1-1 Cuda 12000 — Chassis Front View

Rear View

The rear of the Cuda 12000 provides access to power terminals, network connectors, and slot backplates, as shown in Figure 1-2.

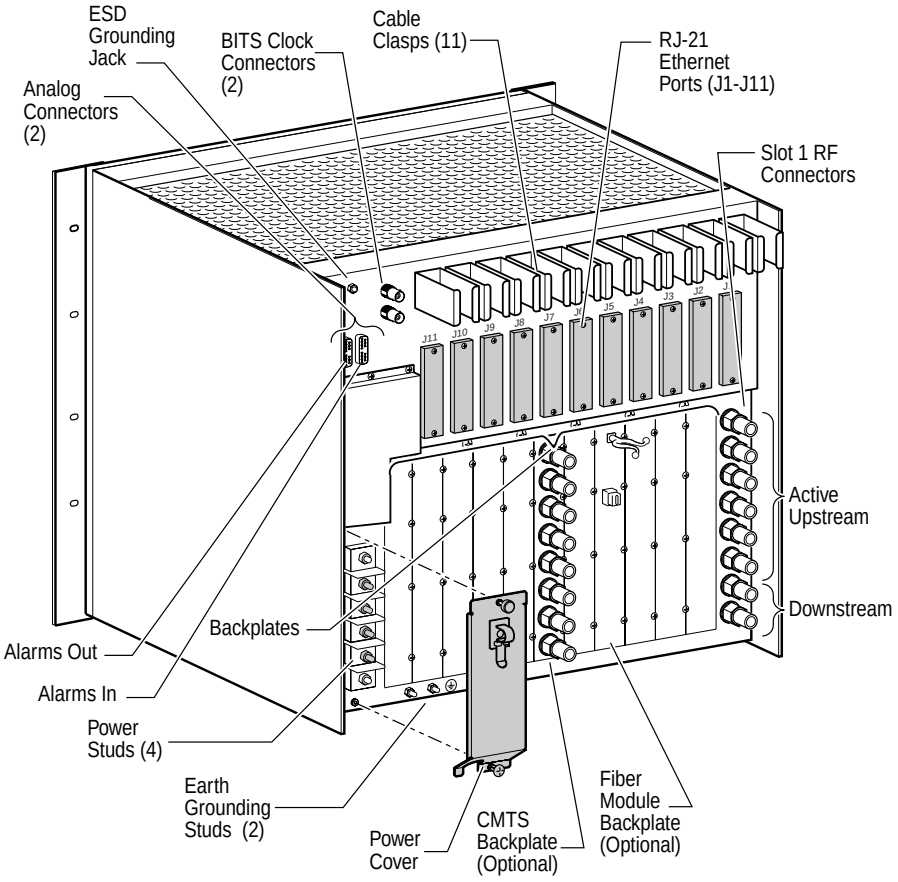


Figure 1-2 Cuda 12000 — Chassis Rear View

You can access these components from the rear of the chassis:

Component	Description
Power Studs	Four 1/4" threaded power studs provide connection to two power sources. A source/return pair is offered for both power sources—A and B.
RJ-21 Ethernet Ports	These Champ-style RJ-21 interfaces provide network connectivity to the octal (8-port) 10/100 Ethernet modules for slots 1 through 11 through an external cable and patch panel.
Cable Clasps	Eleven cable clasps provide for cable management and organization on the rear panel.
Earth Grounding Terminals	Two threaded grounding studs support chassis connections to earth ground using an anti-rotational lug.
Backplates	Each rear chassis slot is covered with a blank backplate, or a backplate appropriate to the application module that resides in the slot.
ESD Grounding Jack	Provides a single ESD grounding jack for connection to an ESD wrist strap.
Analog Connectors	Two DB-15 receptacles allow for analog connections for status and alarm monitoring of fan tray, power supplies, and system events. The receptacle on the left is for input, the receptacle on the right is for output.
Building Integrated Timing Supply (BITS) Clock Connectors	Optional Feature: Two BNC connectors allow connection to an external BITS clock.
Slot 1 RF connectors	Slot 1 is shipped DOCSIS/EuroDOCSIS-ready with a permanently fixed DOCSIS module backplate containing six upstream ports and two downstream ports.
Alarms In	This DB-15 receives fault signals from the connected devices. Facing the rear of the chassis, this is the serial connector on the right.
Alarms Out	Transmits fault signals to an external indication device. Facing the rear of the chassis, this is the serial connector on the left. To connect to an external alarm indication device, see the instructions for the device to which you are cabling.

Interior View

The chassis interior provides connection to a number of backplane components, as shown in Figure 1-3.

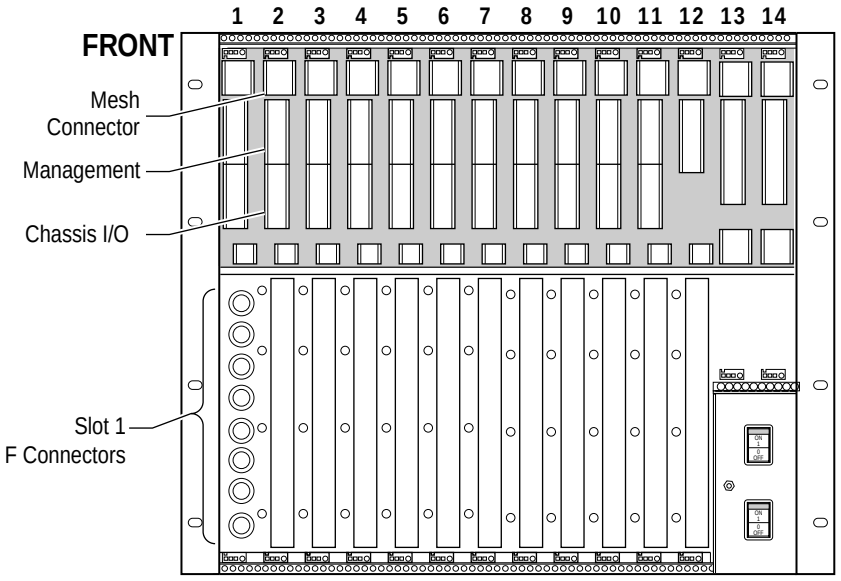


Figure 1-3 Cuda 12000 -- Chassis Interior View

The chassis interior includes these components:

Component	Description
Mesh connectors	Connects each module to the high-speed serial mesh.
Management	Connects all modules to a 100 Mbps management BUS.
Chassis I/O	Connects each module to the RJ-21 port mounted on the rear chassis panel for slots 1 through 11.
Slot 1 F Connectors	Provides a ready-to-cable connection to DOCSIS and EuroDOCSIS modules. ■ The 1x6 DOCSIS SpectraFlow module with Spectrum Management uses all six upstream F connectors and two downstream F connectors. ■ The 1x4 EuroDOCSIS SpectraFlow module with Spectrum Management uses the top four F connectors (upstream) and both of the bottom F connectors (downstream).

Component	Description
	■ The 1x4 DOCSIS, 1x4 DOCSIS SpectraFlow, 1x4 EuroDOCSIS, and 1x4 EuroDOCSIS SpectraFlow modules only use the top four F connectors (upstream) and the single bottom F connector (downstream). These modules do not utilize the remaining three F connectors.

Management Module

The Management module (Figure 1-4) controls the operations of the chassis. It maintains and executes the Cuda 12000 management functionality, including:

- DHCP
- TFTP
- DNS/DDNS
- Time of Day
- Syslog
- Configuration File Manager
- LDAP

The Management module supports internal Stratum-3 clock functionality. The Stratum-3 oscillator is an optional feature that provides a backup for the external clock source. If the external source should fail, the Cuda 12000's internal clock will have the accuracy of a Stratum-3 clock, resulting in a systematic packet loss of less than one packet per hour.

Figure 1-4 shows the Cuda 12000 Management module. Table 1-1 describes the Management module components.

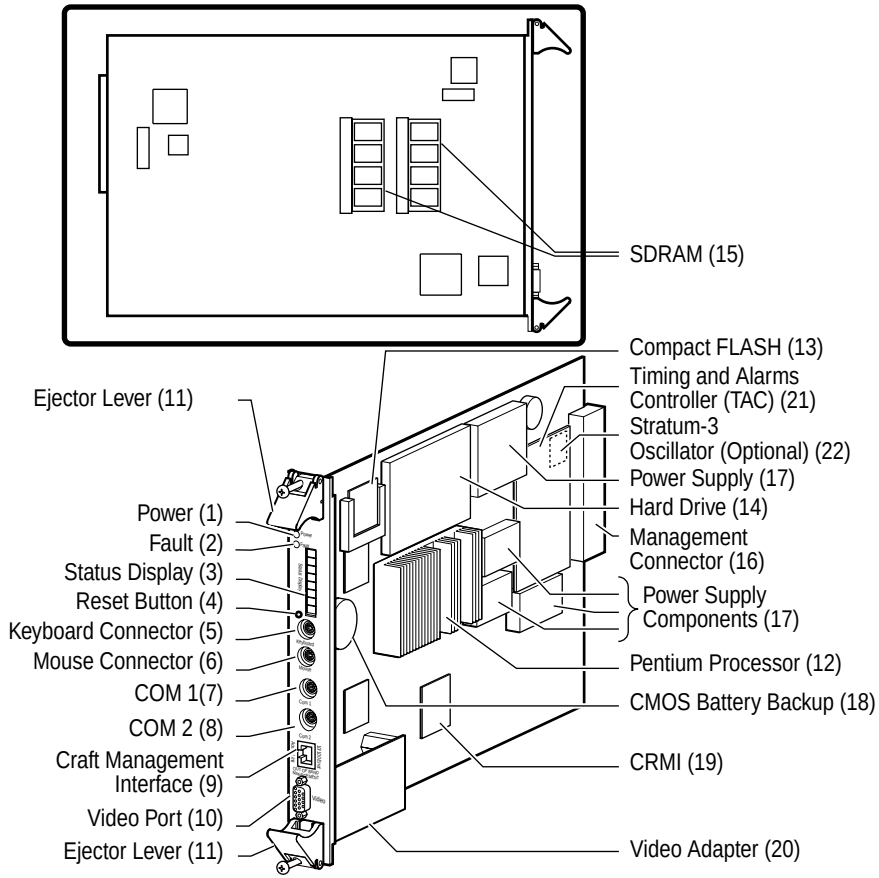


Figure 1-4 Management Module

Table 1-1 Management Module Components

Component	Description
Power (1)	Single green LED that indicates module is receiving power and the initial startup circuitry is working.
Fault (2)	Single red LED that indicates fault conditions exist.
Status display (3)	8-character LED panel that displays module status.
Reset button (4)	Resets the module.
Keyboard connector (5)	Mini-DIN, 6-pin connector used to attach keyboard.
Mouse connector (6)	Mini-DIN, 6-pin connector used to attach mouse.
COM 1 (7)	Mini-DIN, 8-pin connector.
COM 2 (8)	Mini-DIN, 8-pin connector.
CRAFT Management Interface (9)	RJ-45 port for connection to a 10/100 Ethernet network. Used for out-of-band remote and diagnostic management access.
Video port (10)	DB-15 Type II video port for connection to monitor.
Ejector levers (11)	Used to seat or eject modules.
Pentium processor (12)	Module processing unit.
Compact FLASH (13)	Compact FLASH disk socket. Used by the processor primarily for BIOS, diagnostics and the latest configuration file. *Reserved for future functionality.*
Hard drive (14)	Hard disk used by the Pentium in support of the Cuda operating system.
SDRAM (15)	Two 128-megabyte DIMMs provide the pentium with 256 megabytes of synchronous SDRAM for processing of system management functions.
Management connector (16)	Connects the module to a management BUS that consists of two management channels.
Power supply components (17)	Includes a DC-to-DC converter that converts the incoming 48 volt power distribution to appropriate voltages for individual module components.

Table 1-1 Management Module Components (continued)

Component	Description
CMOS battery backup (18)	Provides 3.3-volt battery backup for boot parameters.
CRMI (19)	Centralized Resource Management Interface. Provides miscellaneous board management functions.
Video adapter (20)	Provides digital-to-analog conversion, video memory, and video controller functions to support connection and operation of an external monitor.
Timing and Alarms Controller (TAC) (21)	Provides alarm processing for detection of externally connected fan tray and power supplies. Optional Feature: Stratum-3 Oscillator that supports internal and external clock synchronization.

Application Modules

The basic application modules meet the specifications outlined within DOCSIS, and provide the features necessary to offer data over cable services. This section describes the Cuda 12000 application modules, features of these modules, and common components shared by the modules.

- DOCSIS Modules - CMTS that support DOCSIS 1.0 and DOCSIS 1.1, and provide two-way data communication over your HFC network.
- EuroDOCSIS Modules - CMTS that support EuroDOCSIS specifications and provide two-way data communication over your HFC network.
- Egress Modules:
  - Octal 10/100 Ethernet SpectraFlow Modules - Provide 8 autosensing 10/100 Mbps ports for connection to your Ethernet network.
  - Gigabit Ethernet SpectraFlow Modules - Provide 1000 Mbps connections to single mode or multi mode fiber-optic cable.
  - Packet Over SONET (POS) SpectraFlow Modules - Support high-speed transmission of IP data over OC-3 or OC-12 networks.

Application Module Features

Some of the application modules support a SpectraFlow and/or Spectrum Management feature. These two features are described below:

- **SpectraFlow Application Modules**

  SpectraFlow Modules enable the Cuda 12000 to provide advanced levels of Quality of Service (QoS) beyond DOCSIS 1.1 throughout the Cuda 12000. Heightened transmission ordering, scheduling, and classification facilitate SpectraFlow on every application module within the Cuda 12000, ensuring true QoS throughout the chassis.

- **SpectraFlow DOCSIS/EuroDOCSIS Modules with Spectrum Management (SPM)**

  Some operators may experience upstream noise in their cable systems due to external sources such as thunderstorms, electric motors, etc. Adding SPM to a SpectraFlow DOCSIS/EuroDOCSIS module offers advanced methods to intelligently avoid these types of noisy interferences on the system, providing high service availability even in such unplanned periods of interference. This ensures a transparent migration to a new channel, offering superior signal quality for the subscriber.

Application Module Components

Each application module consists of a high-speed network processor with dedicated Synchronous Burst RAM, and a number of other common components as described in Table 1-2. *A detailed illustration of each module is shown in the sections that follow.*

Table 1-2 Common Application Module Components

Component	Description
Power (1)	Single green LED that indicates module is receiving power.
Fault (2)	Single red LED that indicates fault conditions exist.
Status Display (3)	8-character LED panel that displays module status.

Table 1-2 Common Application Module Components (continued)

Component	Description
Reset button (4)	Resets the module. 10/100 Ethernet, Gigabit Ethernet, POS, and Management modules reboot immediately after you press the reset button. For DOCSIS and EuroDOCSIS modules, you must press the reset button for 5 seconds to initiate reboot. Pressing the reset button less than 5 seconds on the DOCSIS or EuroDOCSIS modules, causes the display to cycle through the upstream frequencies, ie. US1, US2...US6.
Ejector levers (5)	Used to seat or eject modules.
Pentium processor (6)	Processing unit utilized by these modules: ■ DOCSIS modules ■ EuroDOCSIS modules ■ Any egress *(non-DOCSIS/EuroDOCSIS)* module configured for route server operation by ADC.
Compact FLASH (7)	Used by the processors, primarily for BIOS, diagnostics and the latest configuration file. The Compact FLASH is configured with two disk partitions, one partition is used by the Pentium processor, and the other partition is used by the IXP 1200 processor. Each partition stores configuration information specific to the processor and board type.
IXP 1200 Network Processor (8)	Provides line-speed processing of network data.
Synchronous Burst Static RAM (9)	Up to 8 MB SIMM. Dedicated to the network processor for fast-path processing and storage of the routing table. 2 Mb of Sync Burst RAM holds up to 32,000 routing entries.
SDRAM (10)	Bank 1 - Up to 256 MB of SDRAM contained in a 144-pin SO DIMM. Used by the network processor.
SDRAM (11)	Bank 2 - 64 MB of SDRAM contained in a 144-pin SO DIMM. Used by the Pentium II processor mounted on the reverse side of the board.
Mesh Communication Chip (12)	(MCC) ASIC that connects the module to every other module via a high-speed serial link. Connects the network processor to the high-speed serial mesh.
Mesh Connector (13)	Connects the MCC to the high-speed serial mesh.

Table 1-2 Common Application Module Components (continued)

Component	Description
Ethernet Connector (14)	Connects the module to the Fast Ethernet BUS on the backplane.
Management Connector (15)	Connects the module to a management BUS that consists of two management channels.
Power Supply (16)	Includes a DC-to-DC converter that converts the incoming 48 VDC power distribution to appropriate voltages for individual module components.
MAC chip (17)	Responsible for Layer 2 (MAC-layer) functions.
PHY chip (18)	Responsible for OSI Layer 1 (physical layer) transmit/receive functions. *Note that the Octal 10/100 Ethernet module uses two chips consisting of four ports each.*
Temperature sensor (19)	Sends an Interrupt in the event that operating temperature exceeds the acceptable limit of 70°C.

DOCSIS Modules

DOCSIS (*Data Over Cable Service Interface Specification)* modules interface with your cable network and support automated registration of DOCSIS-compliant cable modems. These modules currently support DOCSIS 1.0 and DOCSIS 1.1.

1x4 DOCSIS Module

The 1x4 DOCSIS module offers four upstream RF ports and a single downstream RF port. The 4 upstream ports each provide up to a 10 Mbps connection to hybrid fiber coaxial (HFC) cable and support both QPSK and 16 QAM modulation schemes within a frequency range of 5 to 42 MHz.

The single downstream port provides up to a 40 Mbps connection to your HFC network and supports both 64 and 256 QAM modulation schemes within a 93 MHz to 855 MHz frequency range. The downstream port is compliant with ITU J83 Annex B FEC for 6 MHz channelization.

The module is connected to the network by installing a DOCSIS module backplate on the selected slot, then cabled to the RF connectors attached to the backplate. Cabling to the backplate and not to the module itself allows you to remove and replace the module without re-cabling; it also allows you to cable slots in advance. For information about installing a DOCSIS module backplate, see "Backplates"on page 83.

These modules are hot-swappable; this means you can remove and replace the modules with the system powered on and running.

Figure 1-5 shows a 1x4 DOCSIS module. For a description of each numbered callout, see Table 1-2 on page 26.

The 1x4 DOCSIS module has been designed to the DOCSIS 1.0 and DOCISIS 1.1 specifications.

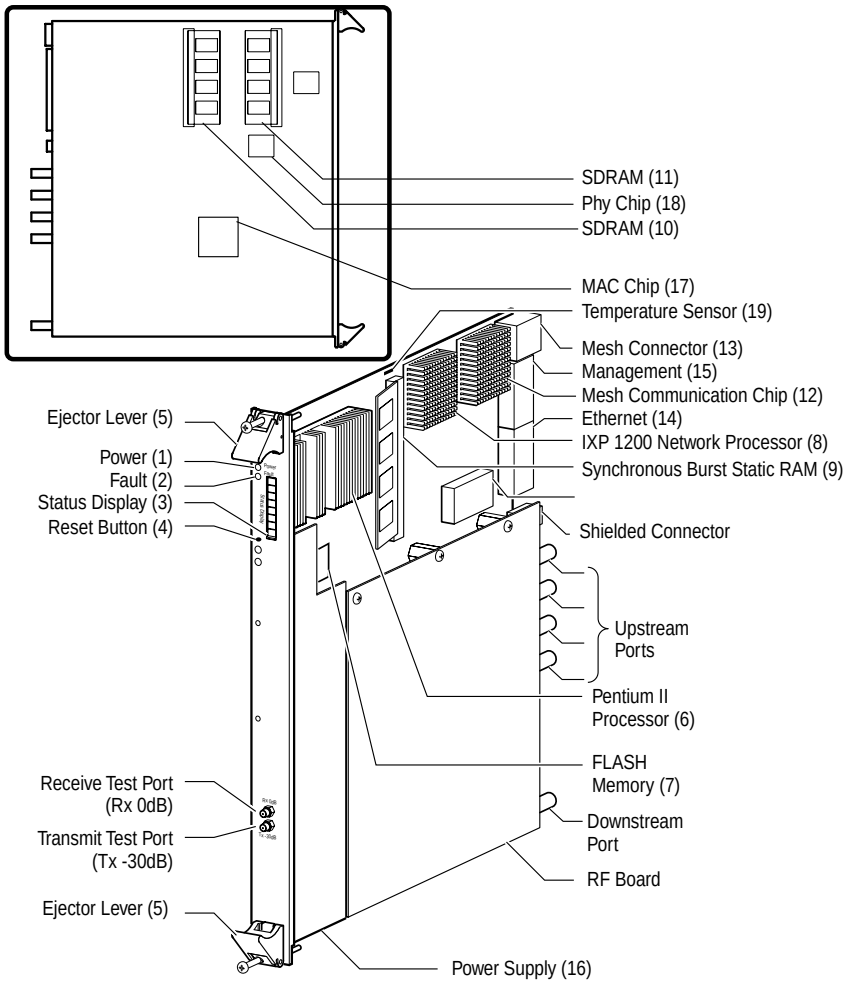


Figure 1-5 1x4 DOCSIS Module

1x4 DOCSIS SpectraFlow Module

The 1x4 DOCSIS SpectraFlow module offers four upstream RF ports and a single downstream RF port. The four upstream ports each provide up to a 10 Mbps connection to hybrid fiber coaxial (HFC) cable and support both QPSK and 16 QAM modulation schemes within a frequency range of 5 to 42 MHz.

The single downstream port provides up to a 40 Mbps connection to your HFC network and supports both 64 and 256 QAM modulation schemes within a 93 MHz to 855 MHz frequency range. The downstream port is compliant with ITU J83 Annex B FEC for 6 MHz channelization.

The module is connected to the network by installing a DOCSIS module backplate on the selected slot, then cabled to the RF connectors attached to the backplate. Cabling to the backplate and not to the module itself allows you to remove and replace the module without re-cabling; it also allows you to cable slots in advance. For information about installing a DOCSIS module backplate, see "Backplates"on page 83.

These modules are SpectraFlow enabled. For information about SpectraFlow, see "Application Module Features"on page 26.

These modules are hot-swappable; this means you can remove and replace the modules with the system powered on and running.

Figure 1-6 shows a 1x4 DOCSIS SpectraFlow module. For a description of each numbered callout, see Table 1-2 on page 26.

The 1x4 DOCSIS SpectraFlow module has been designed to the DOCSIS 1.0 and DOCSIS 1.1 specifications.

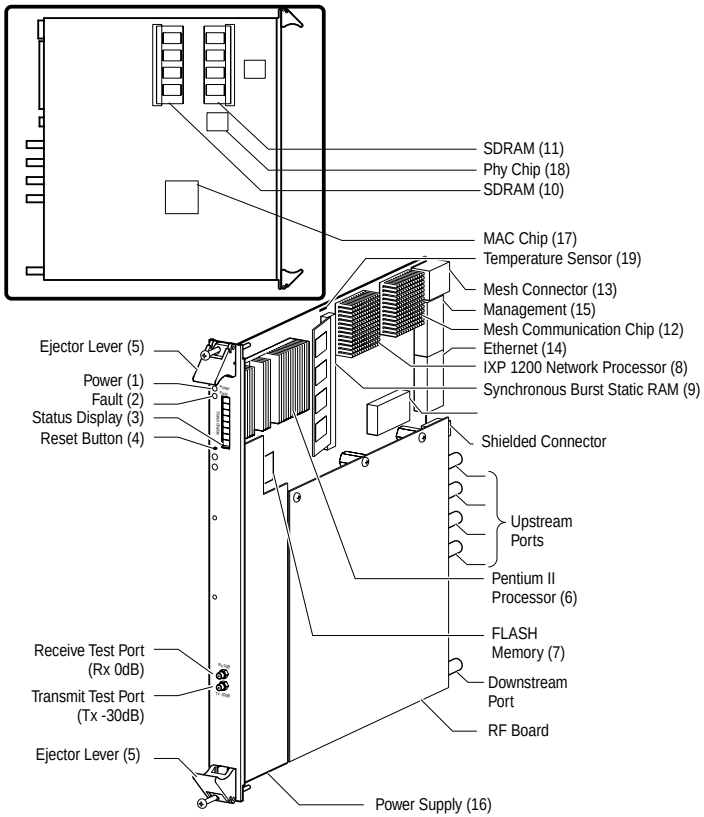


Figure 1-6 1x4 DOCSIS SpectraFlow Module

1x6 DOCSIS SpectraFlow Module with Spectrum Management

The 1x6 DOCSIS SpectraFlow module with Spectrum Management offers six upstream RF ports, which increases the system's upstream port density, and two downstream RF ports. The module contains the internal RF switching capability for the upstream path.

The two downstream ports consist of an active port (F2), that is always activated and contains the downstream carrier, and a failover port (F1), that is only activated during failover. When configured for redundancy mode, the maximum transmit output level is 57dBmV.

If the module is not configured for redundancy mode, then port F2 is unused. Port F1 is then the transmit signal, which has a maximum output level of 50-61dBmV.

The module is connected to the network by installing a DOCSIS module backplate on the selected slot, then cabling to the RF connectors attached to the backplate. Cabling to the backplate and not to the module itself allows you to remove and replace the module without re-cabling. It also allows you to cable slots in advance. For information about installing a DOCSIS module backplate, see "Backplates"on page 83.

These modules are SpectraFlow enabled and support Spectrum Management. For information about SpectraFlow or Spectrum Management, see "Application Module Features"on page 26.

These modules are hot-swappable; this means you can remove and replace the modules with the system powered on and running.

Figure 1-7 shows a 1x6 DOCSIS SpectraFlow with Spectrum Management module. For a description of each numbered callout, see Table 1-2 on page 26.

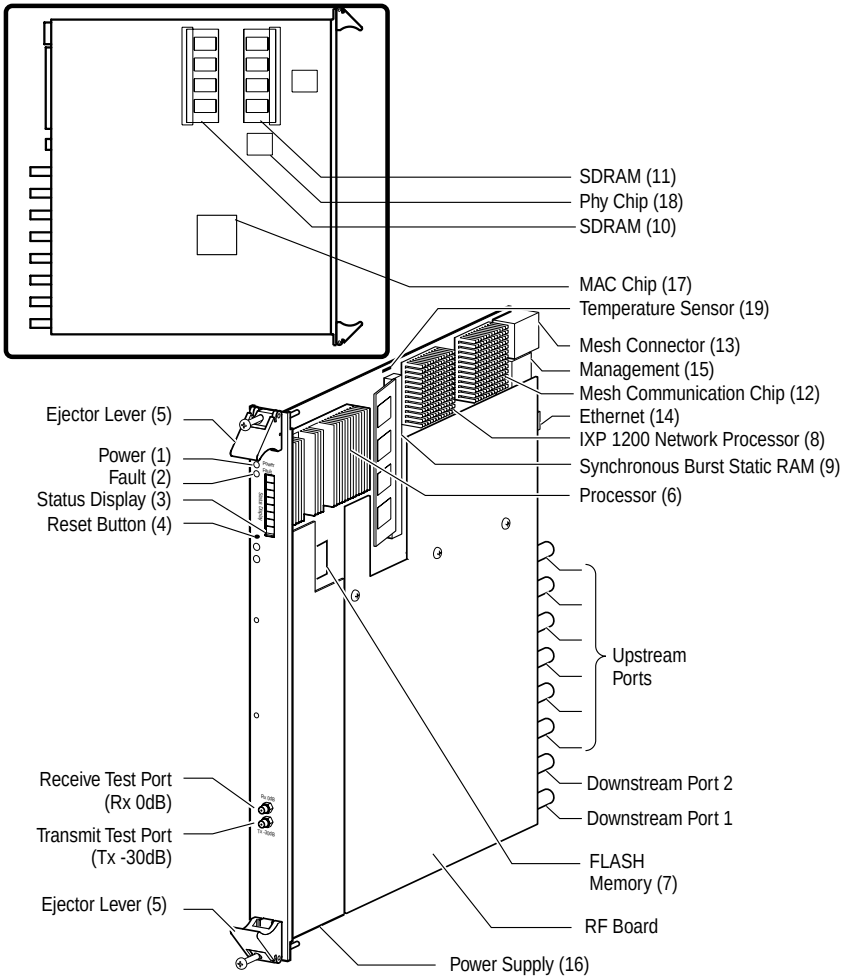


Figure 1-7 1x6 DOCSIS SpectraFlow Module with Spectrum Management

EuroDOCSIS Modules

EuroDOCSIS *(European Data Over Cable Service Interface Specification)* modules interface with your cable network and support automated registration of EuroDOCSIS 1.0-compliant cable modems.

1x4 EuroDOCSIS Module

The 1x4 EuroDOCSIS module offers four upstream RF ports and a single downstream RF port. The four upstream ports each provide up to a 10 Mbps connection to hybrid fiber coaxial (HFC) cable and support both QPSK and 16 QAM modulation schemes within a frequency range of 5 to 65 MHz.

The single downstream port provides up to a 40 Mbps connection to your cable network and supports both 64 and 256 QAM modulation schemes within a 91 MHz to 858 MHz frequency range. The downstream port is compliant with ITU J83 Annex A FEC for 8 MHz channelization.

The module is connected to the network by installing a DOCSIS module backplate on the selected slot, then cabled to the RF connectors attached to the backplate. Cabling to the backplate and not to the module itself allows you to remove and replace the module without re-cabling; it also allows you to cable slots in advance. For information about installing a DOCSIS module backplate, see "Backplates"on page 83.

These modules are hot-swappable; this means you can remove and replace the modules with the system powered on and running.

Figure 1-9 shows a 1x4 EuroDOCSIS module. For a description of each numbered callout, see Table 1-2 on page 26.

The 1x4 EuroDOCSIS module has been designed to the EuroDOCSIS specification.

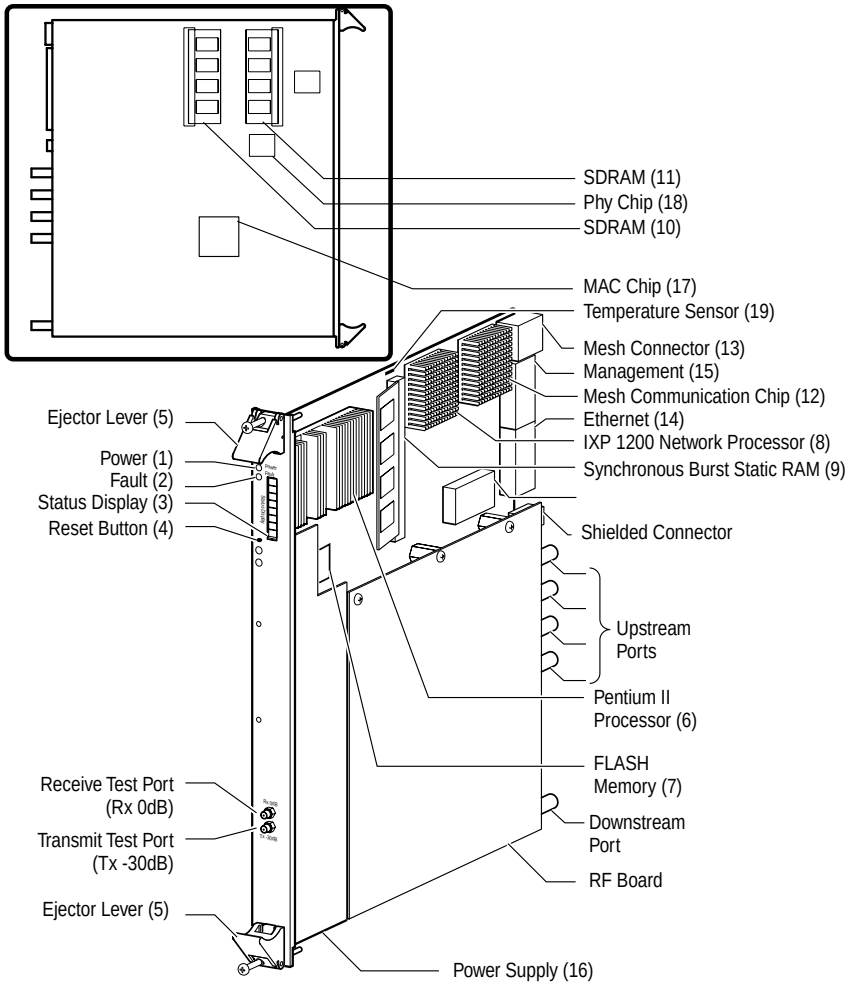


Figure 1-8 1x4 EuroDOCSIS Module

1x4 EuroDOCSIS SpectraFlow Module

The 1x4 EuroDOCSIS SpectraFlow module offers four upstream RF ports and a single downstream RF port. Each of the four upstream ports provide up to a 10 Mbps connection to HFC cable and support both QPSK and 16 QAM modulation schemes within a frequency range of 5 to 65 MHz.

The single downstream port provides up to a 40 Mbps connection to your cable network and supports both 64 and 256 QAM modulation schemes within a 91 MHz to 858 MHz frequency range. The downstream port is compliant with ITU J83 Annex A FEC for 8 MHz channelization.

The module is connected to the network by installing a DOCSIS module backplate on the selected slot, then cabling to the RF connectors attached to the backplate. Cabling to the backplate and not to the module itself allows you to remove and replace the module without re-cabling. It also allows you to cable slots in advance. For information about installing a DOCSIS module backplate, see "Backplates" on page 83.

These modules are SpectraFlow enabled. For information about SpectraFlow, see "Application Module Features"on page 26.

These modules are hot-swappable; this means you can remove and replace the modules with the system powered on and running.

Figure 1-9 shows a 1x4 EuroDOCSIS SpectraFlow module. For a description of each numbered callout, see Table 1-2 on page 26.

The 1x4 EuroDOCSIS SpectraFlow module has been designed to the EuroDOCSIS specification.

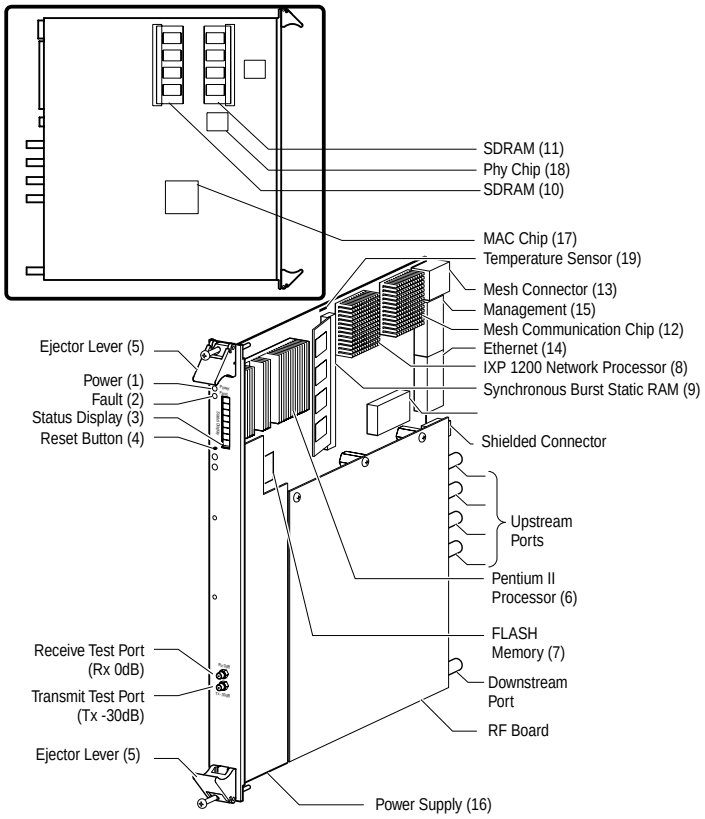


Figure 1-9 1x4 EuroDOCSIS SpectraFlow Module

1x4 EuroDOCSIS SpectraFlow Module with Spectrum Management

The 1x4 EuroDOCSIS SpectraFlow module with Spectrum Management offers four upstream RF ports and two downstream RF ports. Each of the 4 upstream ports provide up to a 10 Mbps connection to HFC cable and support both QPSK and 16 QAM modulation schemes within a frequency range of 5 to 65 MHz.

The two downstream ports consist of an active port (F2), that is always activated and contains the downstream carrier, and a failover port (F1), that is only activated during failover. When configured for redundancy mode, the maximum transmit output level is 57dBmV.

If the module is not configured for redundancy mode, then port F2 is unused. Port F1 is then the transmit signal, which has a maximum output level of 50-61dBmV.

The module is connected to the network by installing a DOCSIS module backplate on the selected slot, then cabling to the RF connectors attached to the backplate. Cabling to the backplate and not to the module itself allows you to remove and replace the module without re-cabling. It also allows you to cable slots in advance. For information about installing a DOCSIS module backplate, see "Backplates" on page 83.

These modules are SpectraFlow enabled and support Spectrum Management. For information about SpectraFlow or Spectrum Management, see "Application Module Features"on page 26.

These modules are hot-swappable; this means you can remove and replace the modules with the system powered on and running.

Figure 1-10 shows a 1x4 EuroDOCSIS SpectraFlow module with Spectrum Management. For a description of each numbered callout, see Table 1-2 on page 26.

The EuroDOCSIS module has been designed to the EuroDOCSIS specification.

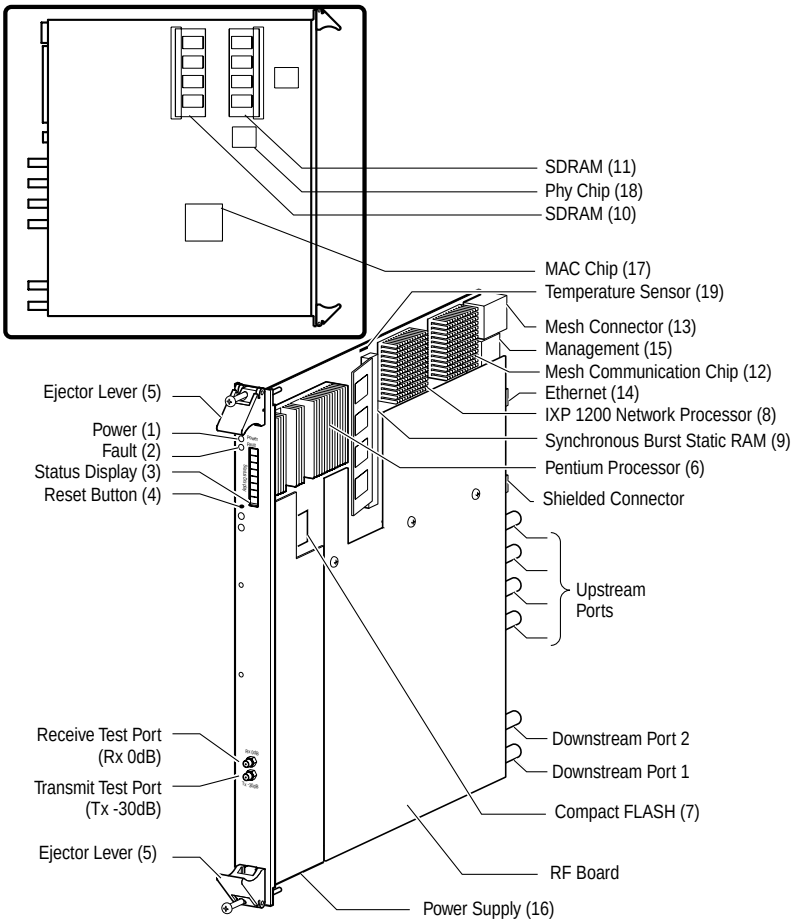


Figure 1-10 1x4 EuroDOCSIS SpectraFlow Module with Spectrum Management

Egress Modules

Each Egress (non-DOCSIS) module has an independent network processor and Synchronous Burst RAM sources. As a result, processing power and memory scale with every module that you install in the chassis.

Octal 10/100 Ethernet SpectraFlow Modules

The Octal 10/100 Ethernet SpectraFlow module (Figure 1-11) contains eight auto negotiating 10/100BASE-TX Fast Ethernet ports that support connection to UTP Category 5 copper wire. The module auto senses 10/100 Mbps, full duplex, and half duplex connections and complies with all IEEE 802.3u specifications. The module is hot-swappable; this means you can remove and replace the module with the system powered on and running.

Connection to this module is achieved though the RJ-21 Champ-style connector mounted on the rear chassis for slots 1 through 11. Cabling to the RJ-21 connector and not to the module itself allows you to remove and replace the module without re-cabling. It also allows you to cable slots in advance.

Chassis slot 12 does not have a RJ-21 connector associated with it and does not support installation of 10/100 Ethernet SpectraFlow modules.

The module functions as a layer 3 switch and forwards packets at wire speed on all ports simultaneously; it supports a transmission distance of up to 100 meters.

Table 1-3 Octal 10/100 Ethernet SpectraFlow Module Transmission Range

Wire Type	Transmission Distance	Line Ratio
UTP Cat 5	100 meters	10/100 Mbps

In addition to the common module components found on each application module, the 10/100 Ethernet SpectraFlow module offers an LED port status display consisting of eight rows of four LEDs—one row for each Ethernet port. For each Ethernet interface, these LED status are shown:

LED	Description
ACTIVE	Illuminates when forwarding data.
FDX	Indicates full-duplex link.
LINK	Indicates a valid link to the network.

LED	Description
100 MB	Illuminates when link speed is 100 Mbps; otherwise speed is 10 Mbps.

Figure 1-11 shows an Octal 10/100 Ethernet SpectraFlow module. For a description of each numbered callout, see Table 1-2 on page 26.

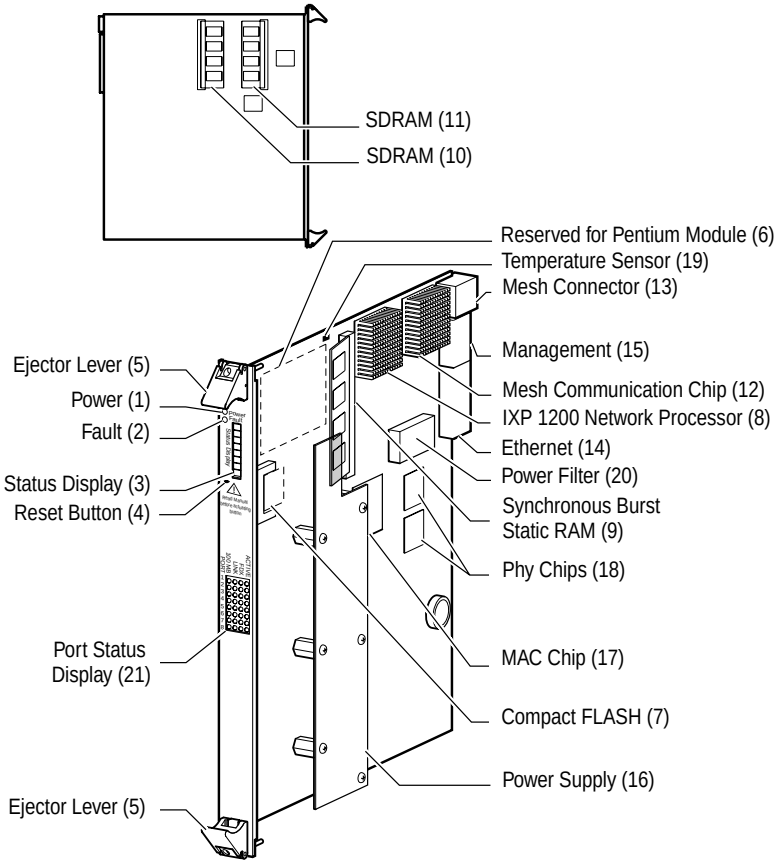


Figure 1-11 Octal 10/100 Ethernet SpectraFlow Module

Gigabit Ethernet SpectraFlow Modules

The system supports connection to Gigabit Ethernet networks using these modules:

Gigabit Ethernet Module	Description
1000BASE-SX	Provides a 1000 Mbps Ethernet connection over 62.5 or 50 micron multi mode fiber-optic cable.
1000BASE-LX	Provides a 1000 Mbps Ethernet connection over 9 micron single-mode fiber-optic cable and supports a transmission distance of up to 10 kilometers or more.

These modules connect to the network using an ADC-provided fiber-optic cable. This fiber optic cable consists of a duplex SC connector on one end and an AMP MPX connector on the other end. Connect the module to the network by installing a fiber module backplate on the selected slot, then inserting the AMP MPX connector into the blind-mate fiber port located on the backplate. Cabling to the backplate and not to the module itself allows you to remove and replace the module without re-cabling. It also allows you to cable slots in advance.

These single-port modules comply with IEEE 802.3z specifications. Table 1-4 shows the transmission ranges for the 1000BASE-SX modules.

Table 1-4 1000BASE-SX Transmission Ranges

Fiber Type	Diameter (microns)	Wavelength (Nanometers)	Transmission Distance	Optical Output Power	Input Sensitivity
Multi mode	50	850	500 meters	■ Min: -9.5 dBm ■ Max: -4 dBm	■ Min: -17 dBm ■ Max: 0 dBm
Multi mode	62.5	850	220 meters	■ Min: -9.5 dBm ■ Max: -4 dBm	■ Min: -17 dBm ■ Max: 0 dBm

Table 1-5 shows the transmission range for the 1000BASE-LX modules.

Table 1-5 1000BASE-LX Transmission Ranges

Fiber Type	Diameter (microns)	Wavelength (Nanometers)	Transmission Distance	Optical Output Power	Input Sensitivity
Single mode	9	1300	10 kilometers	■ Min: -9.5 dBm ■ Max: -3 dBm	■ Min: -20 dBm ■ Max: -3 dBm

In addition to the common module components found on each application module, each Gigabit Ethernet SpectraFlow module includes an LED display that provides these port status:

Status	Description
Tx	Indicates the module is transmitting a Gigabit Ethernet packet from the module.
Rx	Indicates the module is receiving a Gigabit Ethernet packet.
LINK	Indicates a valid connection to the network. Illuminates when a MAC-layer link is detected.
SIG DET (Signal Detect)	Indicates a valid signal is detected. Illuminates when optical energy is detected.

Figure 1-12 shows a Gigabit Ethernet SpectraFlow module. For a description of each numbered callout, see Table 1-2 on page 26.

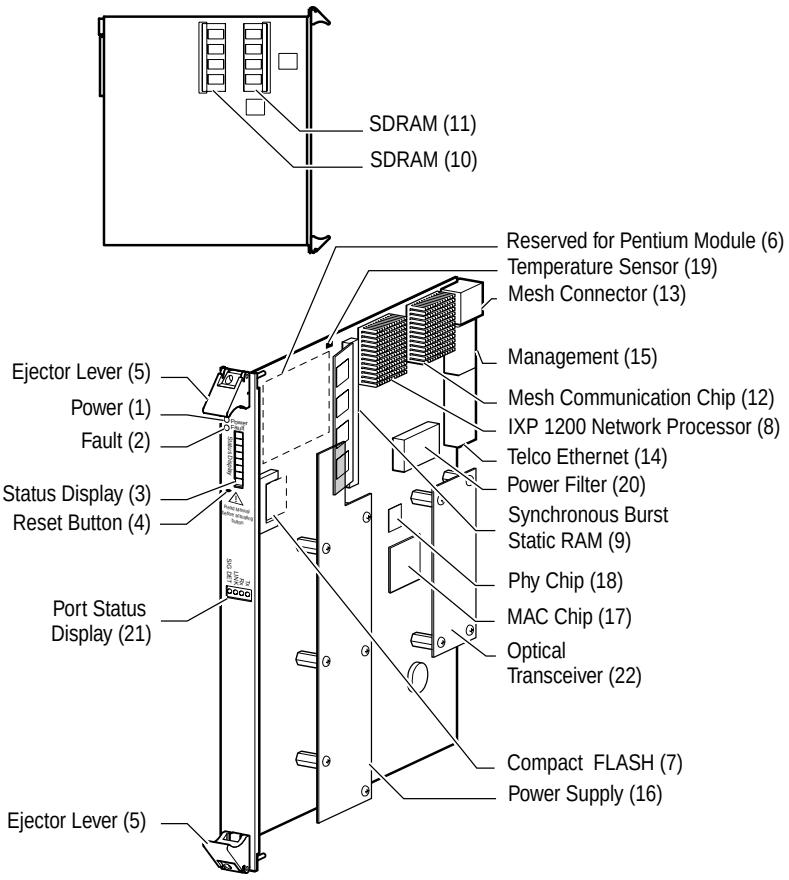


Figure 1-12 Gigabit Ethernet SpectraFlow Module

Packet Over SONET (POS) SpectraFlow Modules

The system supports transmission of IP data directly over Synchronous Optical Network (SONET) to more efficiently utilize bandwidth and leverage the management, fault-tolerance, and high transmission speeds inherent in SONET networks.

The system supports connection to SONET networks using these modules:

POS Module	Description
POS OC-3	Provides a 155 Mbps connection to SONET STS-3c or SDH STM-1 networks.
POS OC-12	Provides a 622 Mbps connection to SONET STS-12c or SDH STM-4 networks.

POS modules connect to the network using the provided fiber-optic cable. This fiber optic cable consists of a duplex SC connector on one end and an AMP MPX connector on the other end. The module is connected to the network by installing a fiber module backplate on the selected slot, then inserting the AMP MPX connector into the blind-mate fiber port located on the backplate. Cabling to the backplate and not to the module itself allows you to remove and replace the module without re-cabling. It also allows you to cable slots in advance.

Both OC-3 and OC-12 POS modules are available in a number of configurations. Table 1-6 shows the available configurations and associated parameters of OC-3 modules.

Table 1-6 POS OC-3 Configurations

Fiber Type	Diameter (microns)	Wavelength (nanometers)	Transmission Distance	Optical Output Power	Input Sensitivity
Multi mode	62.5	1300	2 kilometers	■ Min: -20 dBm ■ Max: -14 dBm	■ Min: -31 dBm ■ Max: -14 dBm
Single mode	9	1300	15 kilometers	■ Min: -15 dBm ■ Max: -8 dBm	■ Min: -31 dBm ■ Max: -8 dBm
Single mode	9	1300	40 kilometers	■ Min: -5 dBm ■ Max: 0 dBm	■ Min: -34 dBm ■ Max: -8 dBm

Table 1-7 shows the available configurations and associated parameters of OC-12 modules.

Table 1-7 OC-12 Configurations

Fiber Type	Diameter (microns)	Wavelength (Nanometers)	Transmission Distance	Optical Output Power	Input Sensitivity
Multi mode	62.5	1300	500 meters	■ Min: -20 dBm ■ Max: -14 dBm	■ Min: -26 dBm ■ Max: -14 dBm
Single mode	9	1300	15 kilometers	■ Min: -15 dBm ■ Max: -8 dBm	■ Min: -28 dBm ■ Max: -7 dBm
Single mode	9	1300	40 kilometers	■ Min: -5 dBm ■ Max: 0 dBm	■ Min: -34 dBm ■ Max: -8 dBm

In addition to the common module components found on each application module, each POS SpectraFlow module includes an LED display that provides these port status:

Status	Description
ACTIVITY	Indicates a packet is transmitting from, or received to the module.
BER (Bit Error Rate)	Indicates the BER threshold has been exceeded.
LOF (Loss of Frame)	Indicates a loss of frame condition has occurred.
SIG DET (Signal Detect)	Indicates a valid signal. Illuminates when optical energy is detected.

Figure 1-13 shows a POS SpectraFlow module. For a description of each numbered callout, see Table 1-2 on page 26.

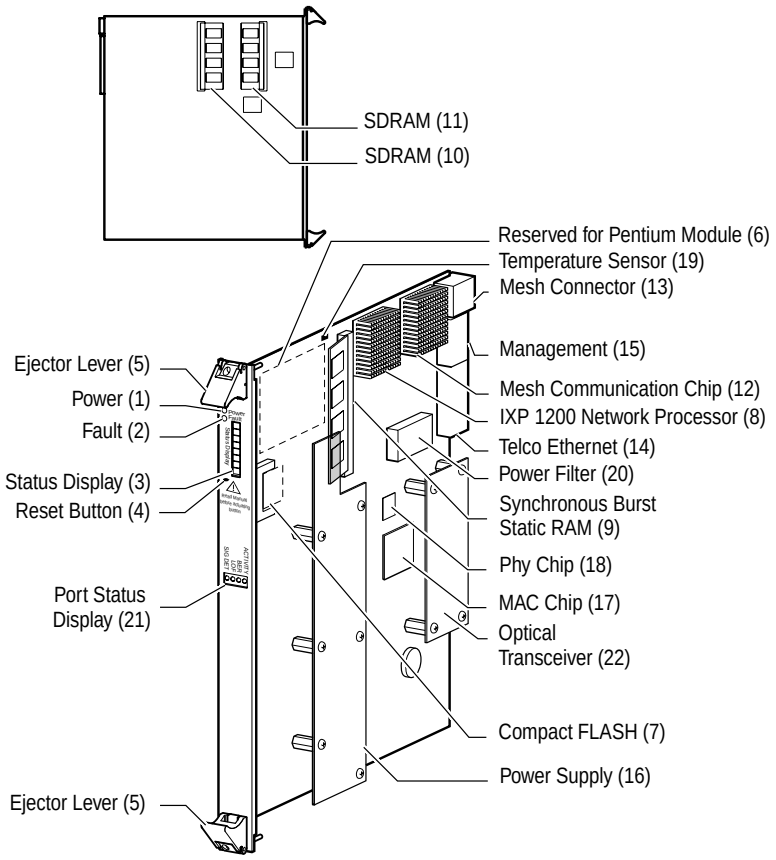


Figure 1-13 POS SpectraFlow Module

Fan Tray

The fan tray for the Cuda 12000, shown in Figure 1-14, contains three hot-swappable fan modules encased within a 2U, 17.25"W x 3.5"H x 15.5"D aluminum chassis. Each fan module within the assembly contains two 5-inch fans; these six fans provide cooling for a single chassis.

Three LEDs located on the front panel indicate the operational status of each fan module within the assembly; green indicates the fan module is operational; red indicates failure. In case of failure, the affected fan module can be replaced without interruption to other fan modules within the unit.

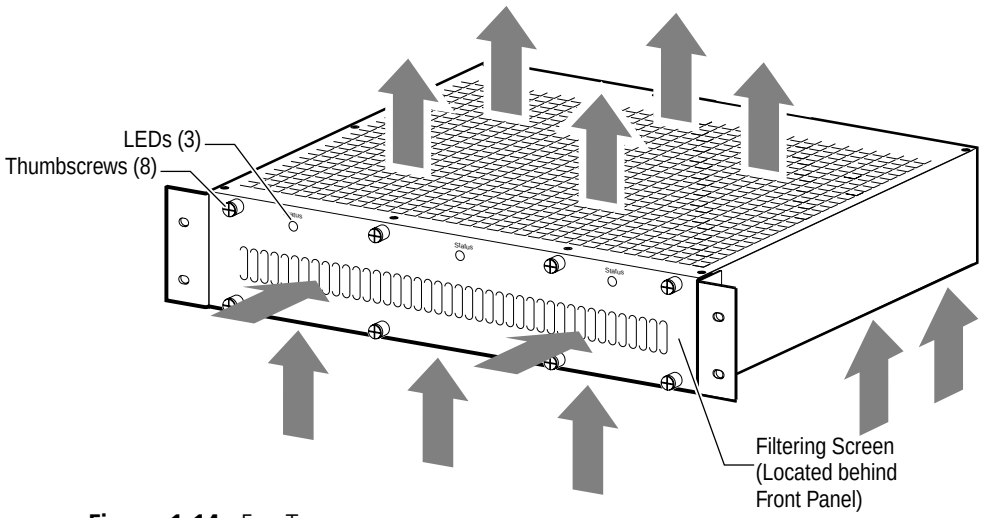


Figure 1-14 Fan Tray

The fan tray draws in cooling air and pushes it up into the above system. Intake vents on the front panel provide additional air flow. A sensor within the unit monitors the temperature of the inlet air stream. If the temperature of the air drawn into the unit is higher than desirable, all three LEDs on the front of the unit illuminate red to indicate a fault condition. The front panel is secured in place with eight captive thumbscrews.

The top, bottom, front, and rear of the system must remain unobstructed to ensure adequate airflow and prevent overheating.

The fan tray must be mounted directly below each Cuda 12000. For information on the proper placement of the fan tray within the rack, see *"System Placement in the Rack"* on page 64.

Replacing the Fan Tray Filtering Screen

You should periodically check the filtering screen for an accumulation of dust and other matter. The fan tray filter catches dust, which can reduce air flow and over time impact the efficiency and effectiveness of the fans. If the filter looks dirty, use the following procedure to replace the filtering screen:

1. Loosen the 8 captive screws which secure the front panel to the fan tray.
2. Pull the front panel from the fan tray unit, as shown in Figure 1-15.
3. Slide the filtering screen from the front panel, as shown in Figure 1-15.
4. Slide the replacement filter into the front panel.
5. Align the front panel so the three holes in the panel are aligned with the LEDs on the fan tray unit. Place the panel against the front of the fan tray and secure the panel in place by tightening the eight captive screws.

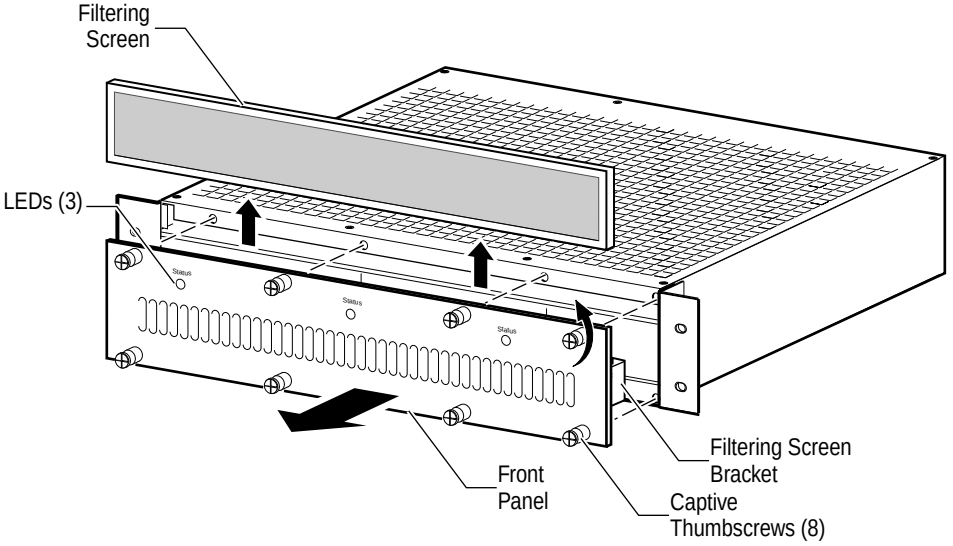


Figure 1-15 Removing the Fan Tray Filtering Screen

Plenums

Plenums facilitate proper air flow through the system by guaranteeing the minimum space necessary for proper system ventilation. The ADC plenum utilizes a single design that allows it to function in both an intake and exhaust capacity. When functioning in an intake capacity, the plenum is placed below each fan tray in the rack. When functioning in an exhaust capacity, the plenum is placed directly above the chassis.

The plenum is a 3 1/2"H x 17 1/8 W x 16 1/4"D high-grade aluminum chamber. Plenums are shipped rackmount-ready with brackets fixed to each side of the unit.

Figure 1-16 shows the Cuda 12000 plenum design and resulting air flow paths.

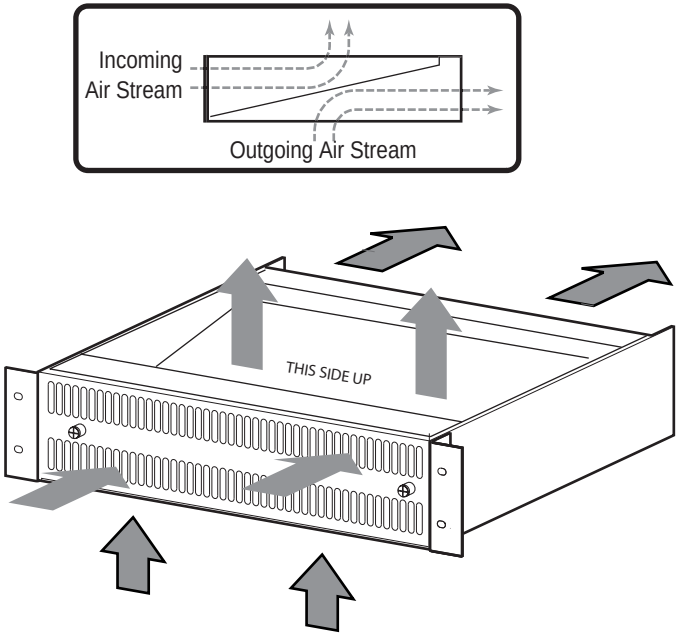


Figure 1-16 Plenum Design and Air Flow

When serving as an intake plenum, the fan tray mounts directly above the plenum to draw air through the plenum's vented front panel and up in the system above.

A filtering screen is placed immediately behind the vented front panel to clean the incoming air stream prior to circulation up through the system. Replacement filters are available through ADC.

When serving as an exhaust plenum, the fan trays mounted directly below each chassis push air up through the rack-mounted systems and into the exhaust plenum.

The first chassis installation requires two plenums; one directly above the chassis, and one below the fan tray. See "System Placement in the Rack" on page 64 for details regarding the proper component order.

Replacing the Plenum Filtering Screen

To replace this filtering screen, see Figure 1-17 and use this procedure:

1. Loosen the two captive thumbscrews that secure the front panel to the plenum.
2. Pull the front panel from the plenum unit, as shown in Figure 1-17.
3. The filtering screen sits between the front panel and a slotted aluminum grid. Remove the filtering screen from behind the front panel.
4. Place the replacement filtering screen onto the slotted grid located at the front of the intake plenum. The filtering screen has two holes that allow you to slip the filtering screen over the two screw cylinders attached to the aluminum grid.
5. Align the front panel so that the two captive thumbscrews located on the front panel align with the two screw cylinders on the aluminum grid. Place the panel against the front of the plenum and secure the panel in place by tightening the two captive screws.

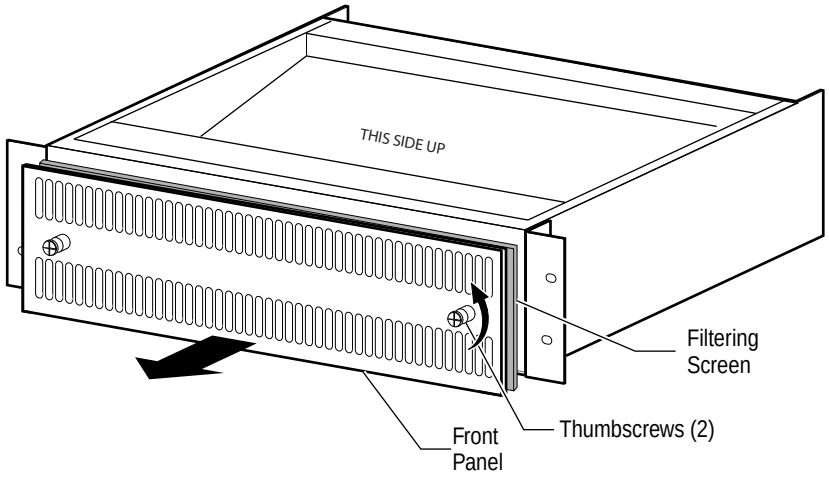


Figure 1-17 Replacing the Plenum Filtering Screen

Ethernet Patch Panel

If you have an Octal 10/100 Ethernet SpectraFlow Module, a Category 5 Ethernet patch panel unit will need to be mounted in your chassis. The patch panel contains 24 RJ-45 port locations on the front that connect to your network. The rear of the patch panel has two RJ-21 ports that connect to the Octal 10/100 Ethernet SpectraFlow modules.

Figure 1-18 shows a front view of the Ethernet patch panel and Figure 1-19 shows the rear view of the Ethernet patch panel.

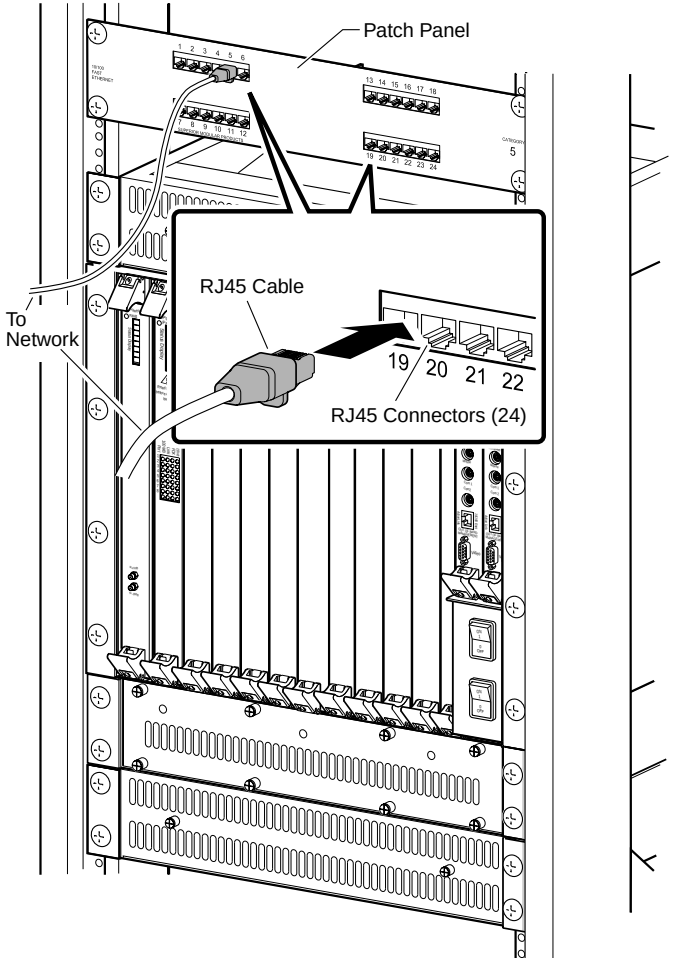


Figure 1-18 Front View of the Category 5 Ethernet Patch Panel

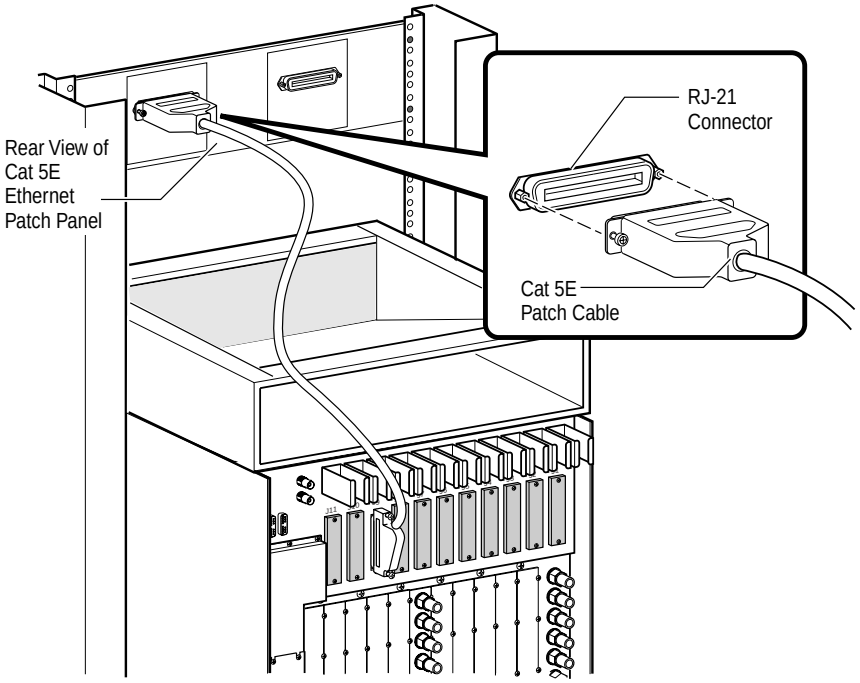


Figure 1-19 Rear View of the Category 5 Ethernet Patch Panel

2 PREPARING FOR INSTALLATION

This chapter provides safety information, site requirements, and other information for installing Cuda 12000 components. This chapter contains:

- Installation Overview
- Safety Guidelines
- Site Requirements
- Pre-Installation Considerations
- Tools for Installation

Installation Overview

The installation process for the Cuda 12000 is described in these steps. Please refer to the detailed instructions for each step before attempting to install the system or any of the components.

1. Review safety guidelines, contained in "*Safety Guidelines,"* next.
2. Prepare the site, as described in *"Site Requirements"* on page 60.
3. Unpack the system and components.
4. Rack mount the system, as described in *Chapter 3*, "*Rack-Mounting the System*."
5. Install system modules, as described in *Chapter 4*, *"Installing Modules*."
6. Cable the System, as described in *Chapter 5*, "*Cabling the System*."
7. Connect the Power, as described in *"Connecting Power"* on page 109.
8. Power On the system, as described in *Chapter 6*, "*Powering On and Powering Off."*

Safety Guidelines

This section provides safety information and other guidelines to help ensure your protection and prevent damage to the system. Observe these guidelines whenever working with the Cuda 12000.

This section does not cover every potentially hazardous condition, so please use proper caution when working with the system.

Safety When Lifting

To help prevent bodily injury when lifting or moving the chassis or other system components, follow these guidelines:

- Don't attempt to lift the chassis by yourself. Always use an appropriate number of personnel to lift and move the chassis.
- When lifting the chassis, ensure that your footing is solid.
- Never move suddenly or twist your body when lifting the chassis.
- If you must bend when lifting the chassis, bend at the knees and not your waist.
- Always disconnect all external cables before moving the chassis.
- Before moving the chassis, ensure that you have an unobstructed path to the rack.

Safety When Rack Mounting

To prevent bodily injury and ensure that the system remains physically stable when mounting or working with the unit, follow these guidelines:

- If this unit is the only device in the rack, mount the unit at the bottom of the rack.
- If the rack is partially filled, you should load the rack from the bottom to the top mounting the heaviest unit at the bottom of the rack.
- If stabilizers are provided with the rack, ensure that they are installed before mounting or working with the rack-mount unit.

Electrical Safety Guidelines and Precautions

WARNING: *Review all guidelines and recommendations in this section before connecting power to the system.*

Before cabling the system power, you must review, understand, and follow these guidelines and precautions:

- Before you connect the power sources to the system, be sure that the circuit to which you are connecting the system is *off* so that all power is removed from the circuit and the wires that you are connecting.
- Take care not to overload the power supply circuit to which you are connecting the system.
- Before proceeding with connecting the power lines to the system, remove all jewelry such as rings, watches, and necklaces.
- Do not work alone whenever potentially hazardous conditions exist.
- Before beginning the power cabling procedure, locate the emergency power-off switch for the location in which you are working.
- Before proceeding with connecting the power lines to the system, check your work area for possible hazards such as ungrounded power extension cables and moist floors.

Avoiding Electrostatic Discharge Damage

Electrostatic Discharge (ESD) can damage module components, causing complete or intermittent failures in operation. ESD can occur when a module is improperly handled. To prevent ESD damage to a system module, follow these guidelines:

- Always wear an ESD grounding device, such as an ESD wrist strap, when handing the chassis component. Connection points are available on the front and rear of the chassis.
- Store the module in its antistatic bag until you are ready to install it.
- Handle the module by its edges to avoid touching any pins, leads, or solder connections on the circuit board.

Site Requirements

You must observe these environmental site requirements to ensure safe operations and proper system performance.

- **Location** — Install this system in a Restricted Access Location.
- **Electrical** — System electrical range: -42V to -68V.
- **Electrostatic** — Always use ESD grounding devices when handling system components.
- **Humidity** — Operating and storage humidity must remain within these ranges:
  - Operating: 10% – 90% *(noncondensing)*
- **Temperature** — Operating and storage temperatures must remain within these ranges:
  - Operating: 0° to 40°c
  - Storage: -40° to 75°c
- **Flooring** — Site flooring must be a non-flammable material.

Pre-Installation Considerations

When planning the installation, please keep these considerations in mind:

- Ensure that the cables are the appropriate length for your installation.
- Ensure that the power cable you are using is long enough to reach the power source.
- ADC provides cables to connect the Fiber modules. The ADC-provided cable consists of an AMP MPX connector on one end, and a duplex SC connector on the other. If the connection to your network does not utilize SC connectors, you will need to provide the appropriate SC-to-<*connector type*> adapter.
- Ensure that you have calculated the attenuation requirements appropriate to your cable plant when cabling DOCSIS and EuroDOCSIS modules.

Tools for Installation

You need these tools and equipment for proper installation of the Cuda 12000:

- #1 Phillips screwdriver
- #2 Phillips screwdriver
- 7/16" socket or wrench
- Antistatic mat if you plan to remove system modules
- ESD grounding strap to prevent Electrostatic Discharge Damage
- Tape measure, especially if you plan to rack-mount the chassis in a partially filled rack

3 RACK-MOUNTING THE SYSTEM

This chapter describes the preparations for rack-mounting the Cuda 12000 and instructions on how to rack-mount a Cuda 12000 chassis and components. This chapter includes:

- Rack-Mount Installation Components
- System Placement in the Rack
- Rack-Mount Order
- Rack-Mounting the Intake Plenum
- Rack-Mounting the Fan Tray
- Rack-Mounting the Chassis
- Rack-Mounting the Exhaust Plenum

CAUTION: *Before proceeding with the procedures in this chapter, read Chapter 2, "Preparing for Installation."*

Rack-Mount Installation Components

The Cuda 12000 is designed for mounting in a TIA/EIA-compliant 19"-wide, Telco-style rack. You can rack-mount up to three systems in a single 7' rack. A proper rack-mount system installation is comprised of these components:

Chassis	Cuda 12000. For information on how to rack-mount the chassis, see *"Rack-Mounting the Chassis"* on page 71.
Fan tray	The fan tray consists of six fans for optimal air flow and cooling of a single chassis. A fan tray is required for each rack-mounted chassis. For example, a three-chassis installation requires 3 fan trays.

Plenums

A proper rack-mount setup of the Cuda 12000 utilizes plenums to facilitate air flow and system cooling. The ADC plenum utilizes a single design to facilitate air flow into the system and out of the system. When used to facilitate the intake of air, it is referred to as an *intake plenum*; each rack-mounted chassis requires an intake plenum. When used to facilitate exhaust of air, it's referred to as an *exhaust plenum*.

Note: The first chassis in the rack requires two plenums.

CAUTION: *If for any reason you are not using plenums, be sure to leave 2 U's of vertical rack space where they would normally be mounted.*

You must also insure that there is adequate airflow in or off of the system.

Two 48 VDC Power Sources

The system supports connection to up to two 48 Volt DC power sources for optimal power availability. Power redundancy ensures that power to the chassis continues uninterrupted should one of the power sources fail.

You will need rack-mount screws to perform the installation procedures in this chapter. Note that ADC does not supply rack-mount screws with the system.

System Placement in the Rack

The number of systems that you want to install influences the placement of the units in the rack. You can mount up to three chassis in a standard 19" Telco rack, assuming a rack height of 7 feet (48 U's). These sections detail the proper installation of up to three chassis in a single rack.

In these sections, vertical rack space is measured in Units (U's). Remember that 1 U is equal to 1.75 inches.

When installing multiple systems in a single rack, only one plenum is required between systems. Refer to Figures 3-2 and 3-3 for the proper installation of multiple chassis in a single rack.

Placement of a Single-Chassis Installation

A single chassis installation occupies a minimum of 15 U's of vertical rack space. This includes 9 U's for the chassis, and 2 U's for the fan tray and each plenum. If this unit is the only device in the rack, it should be mounted towards the bottom of the rack. Figure 3-1 shows the proper rack-mount installation of a single chassis.

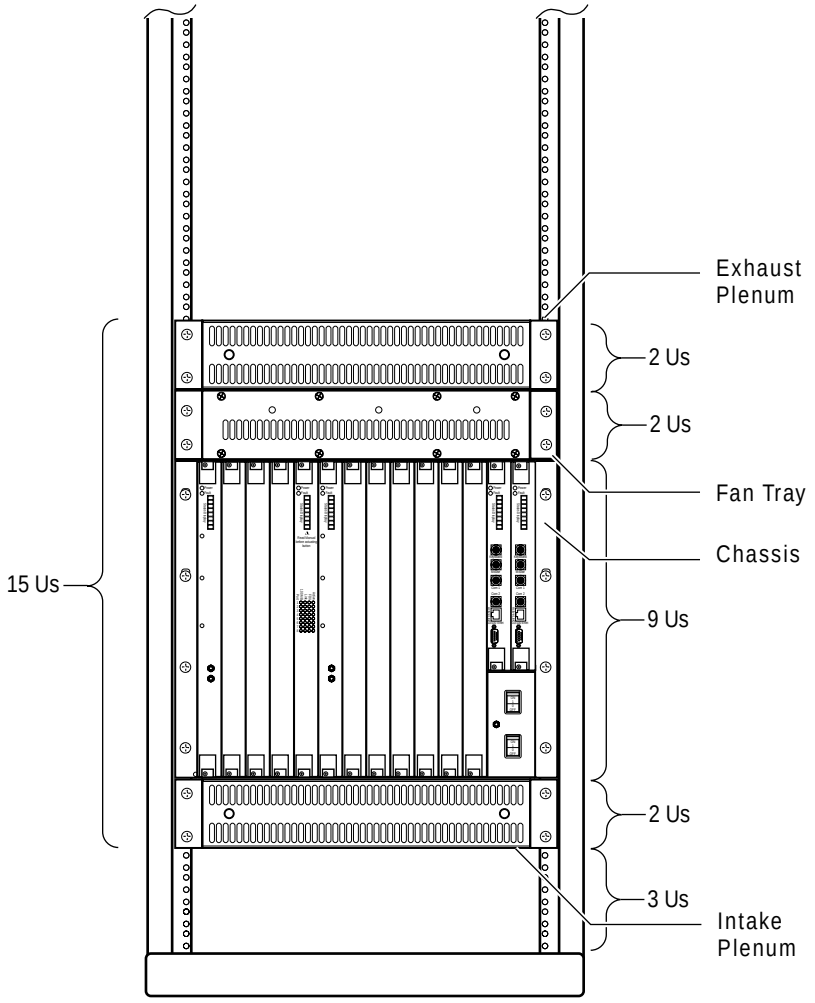


Figure 3-1 Single-Chassis Setup

Placement in a Two-Chassis Installation

A two-chassis installation occupies 28 U's of vertical rack space. This includes 9 U's for *each* chassis, and 2 U's for each plenum and fan tray. If the rack is partially filled, you should load the rack from the bottom to the top with the heaviest unit mounted at the bottom of the rack. Figure 3-2 shows the proper rack-mount installation of two chassis in a single rack.

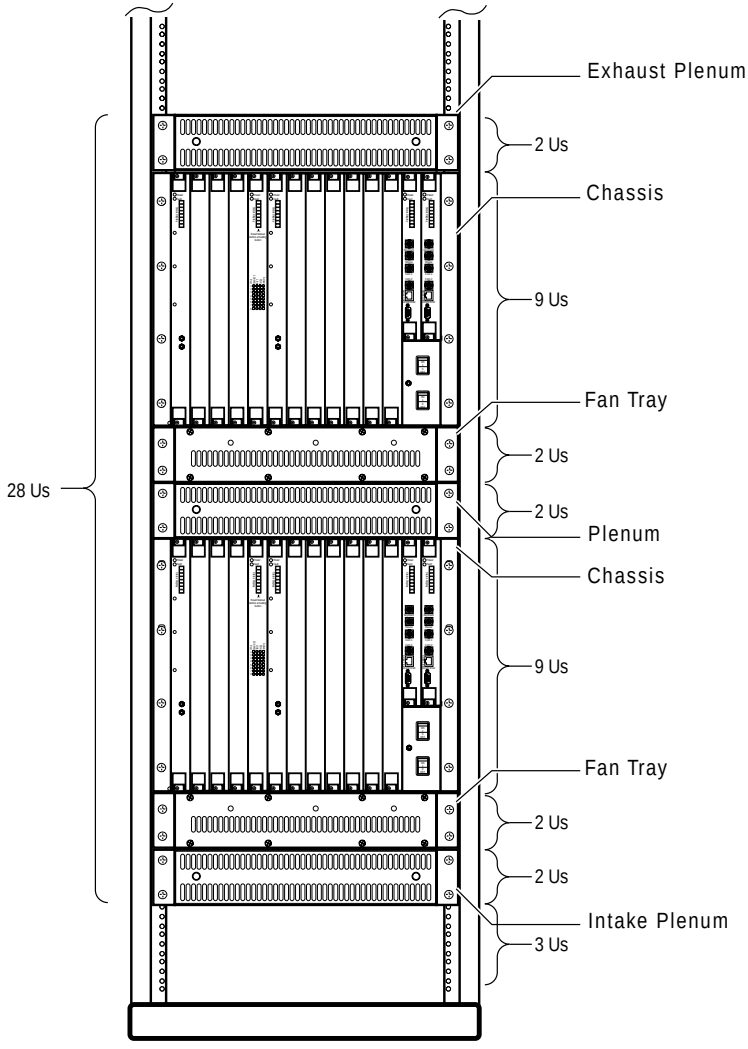


Figure 3-2 Two Chassis Setup

Placement in a Three-Chassis Installation

A three-chassis installation occupies 41 U's of vertical rack space. This includes 9 U's for *each* chassis, and 2 U's for each fan tray and plenum. Figure 3-3 shows the proper installation of three chassis in a single rack.

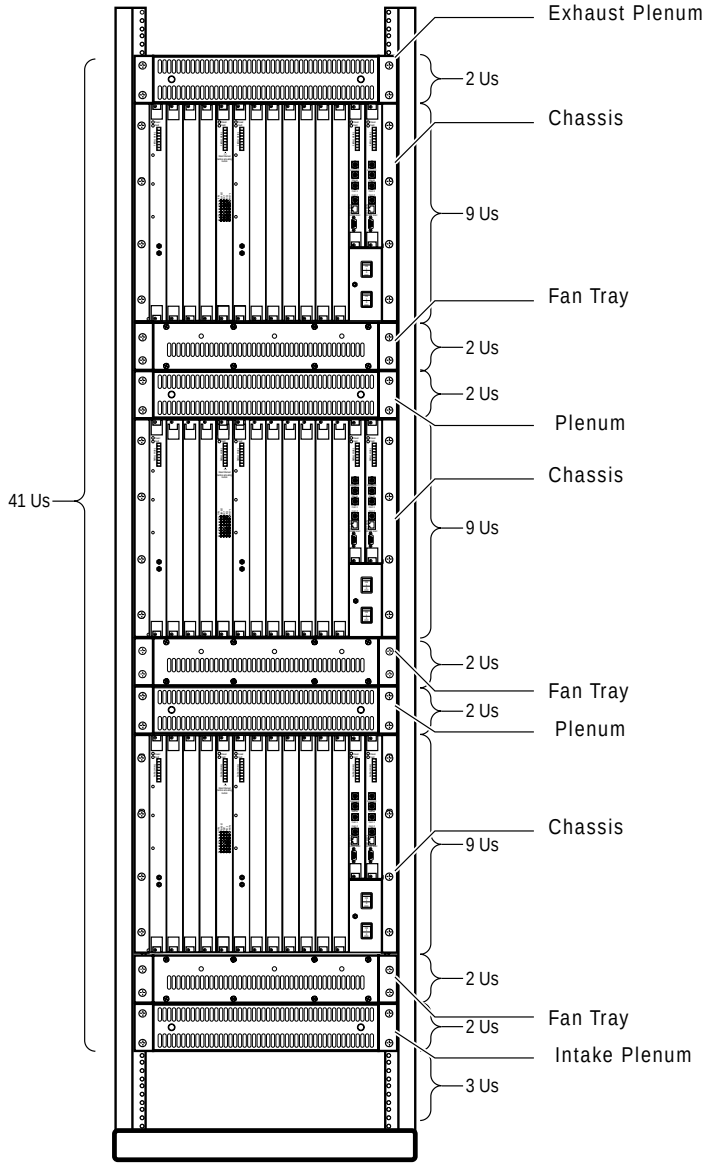


Figure 3-3 Three-Chassis Setup

Rack-Mount Order

The Cuda 12000 components should be rack-mounted in this order:

The rack should be filled from the bottom up.

1. Install the plenum that will facilitate the inflow of air, as described in *"Rack-Mounting the Intake Plenum"* on page 68.
2. Install the fan tray directly above the intake plenum, as described in *"Rack-Mounting the Fan Tray"* on page 69.
3. Install the chassis, as described in *"Rack-Mounting the Chassis"* on page 71.
4. *If you are installing a second chassis*, repeat steps 1 through 3.
5. *If you are installing a third chassis*, repeat steps 1 through 3 again.
6. Install the exhaust plenum, as described in *"Rack-Mounting the Exhaust Plenum"* on page 74.

Rack-Mounting the Intake Plenum

You must rack-mount a plenum directly beneath each fan tray to guarantee the minimum necessary air space of 2 U's *(3 1/2 inches)* and ensure that adequate air flows into the system. A plenum functioning in this capacity is referred to as an *intake plenum*.

You must mount the intake plenum directly below each fan tray in the rack.

For more information on the proper placement of system components in a rack, see "System Placement in the Rack" on page 64.

***CAUTION:** If for any reason you are not using plenums, be sure to leave 2 U's (3.5 inches) of vertical rack space where they would normally be mounted.*

Use this procedure to rack-mount the intake plenum:

1. Determine the placement of the plenum in the rack as described in *"System Placement in the Rack"* on page 64.
2. Position the plenum so that the front end that contains the filtering screen is facing towards you.

3. Ensure that the side stamped "THIS SIDE UP" is facing up and insert the plenum into the rack until the front brackets on each side of the plenum meet the mounting posts, as shown in Figure 3-4. Ensure that the open top is facing up.
4. While keeping the plenum flush against the mounting posts, position the plenum so that the 4 holes in the mounting brackets are aligned with those in the post.
5. Insert all 4 screws *(2 on each side)* into the bracket holes as shown in Figure 3-4. Using the appropriate tool, tighten all the screws so that each one goes through the bracket and into the rack-mount post.

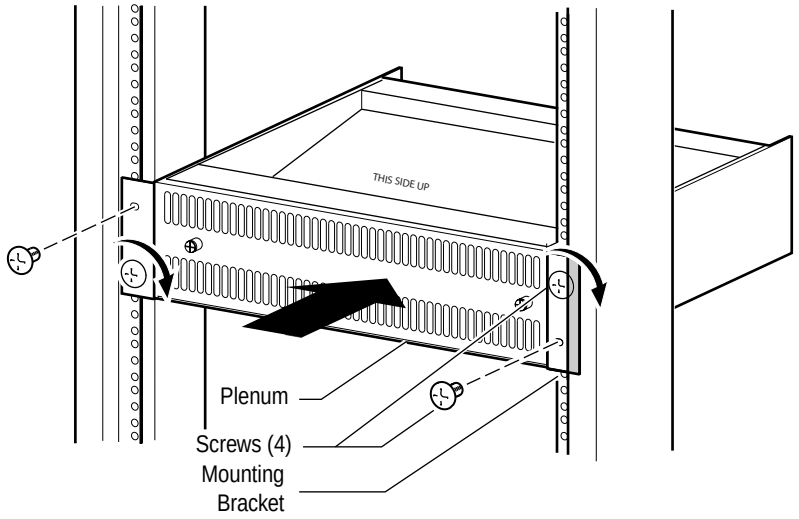


Figure 3-4 Rack-Mounting the Intake Plenum

Rack-Mounting the Fan Tray

The fan tray is comprised of six 12-volt fans that provide cooling for a single chassis. You must mount the fan tray directly below each chassis in the rack.

For more information on the proper placement of system components in a rack, see *"System Placement in the Rack"* on page 64.

Use this procedure to rack-mount the fan tray:

1. Determine the placement of the fan tray in the rack as described in *"System Placement in the Rack"* on page 64.
2. Position the fan tray so that the front end that contains the filtering screen is facing towards you.
3. Position the fan tray above the intake plenum, then insert the fan tray into the rack. Ensure that the front brackets on each side of the fan tray unit meet the mounting posts on each side of the rack, as shown in Figure 3-5.
4. Rest the fan tray unit on top of the plenum to ensure an adequate seal between the bottom of the fan tray and the top of the plenum.
5. While keeping the brackets flush against the mounting posts, position the fan tray so that the 4 holes in the mounting brackets are aligned with those in the post.
6. Insert all four screws *(2 on each side)* into the bracket holes as shown in Figure 3-5. Using the appropriate tool, tighten all the screws so that each one goes through the bracket and into the rack-mount post.

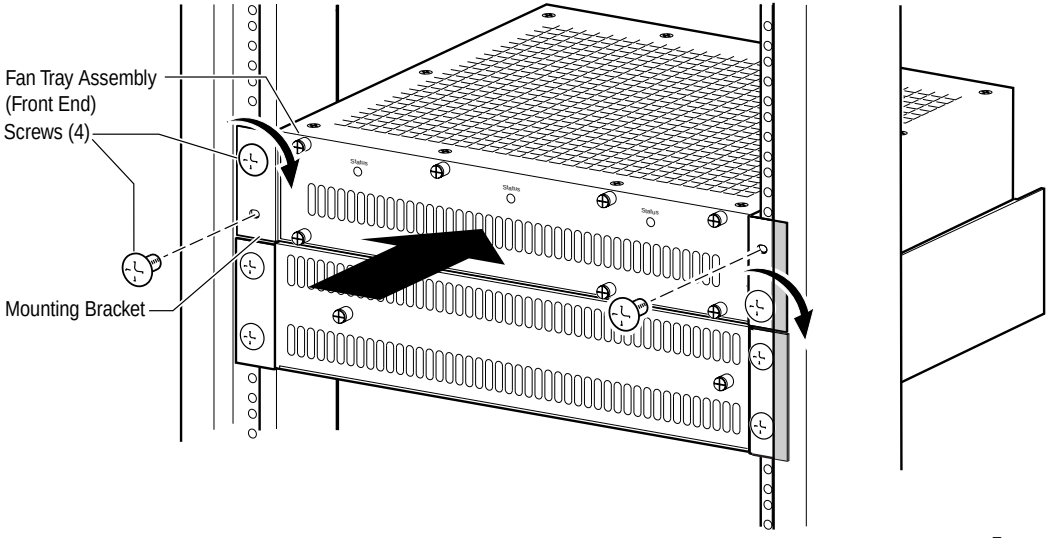


Figure 3-5 Rack-Mounting the Fan Tray

Rack-Mounting the Chassis

The following section describes the procedure for rack-mounting the chassis. There are a number of warnings that should be followed to insure safety.

WARNING: To avoid bodily injury when lifting or moving the chassis, follow these guidelines:

- A fully-loaded chassis can weigh up to 100 pounds. Don't attempt to lift the chassis by yourself. Always use an appropriate number of personnel to lift and move the chassis.
- When lifting the chassis, ensure that your footing is solid.
- Never move suddenly or twist your body when lifting the chassis.
- If you must bend when lifting the chassis, bend at the knees and not your waist.
- Always disconnect all external cables when moving the chassis.
- Ensure that you have an unobstructed path to the rack.

WARNING: To prevent bodily injury and ensure that the system remains physically stable when mounting or working with the unit, follow these guidelines:

- If this unit is the only device in the rack, it should be mounted at the bottom of the rack.
- If the rack is partially filled, you should load the rack from the bottom to the top with the heaviest unit mounted at the bottom of the rack.
- If stabilizers are provided with the rack, ensure that they are installed before mounting or working with the rack-mount unit.

The chassis is shipped rack-mount ready with mounting brackets secured to each side. Use this procedure to rack-mount the chassis:

1. Determine the placement of the chassis in the rack as described in *"System Placement in the Rack"* on page 64.
2. Ensure that any system modules that are installed in the unit are firmly locked in place. All captive screws should also be secured in place.
3. Ensure that you have an unobstructed path to the rack. Also ensure that the rack is stabilized.

Before proceeding, ensure that you have properly installed and secured the intake plenum, as described in "Rack-Mounting the Intake Plenum" on page 68.

4. Using an appropriate number of personnel, move the chassis to the rack.
5. With the front of the chassis facing you, use an appropriate number of personnel to slide the chassis into the rack, pushing it into the rack until the front mounting brackets on the chassis meet the mounting posts, as shown in Figure 3-6.

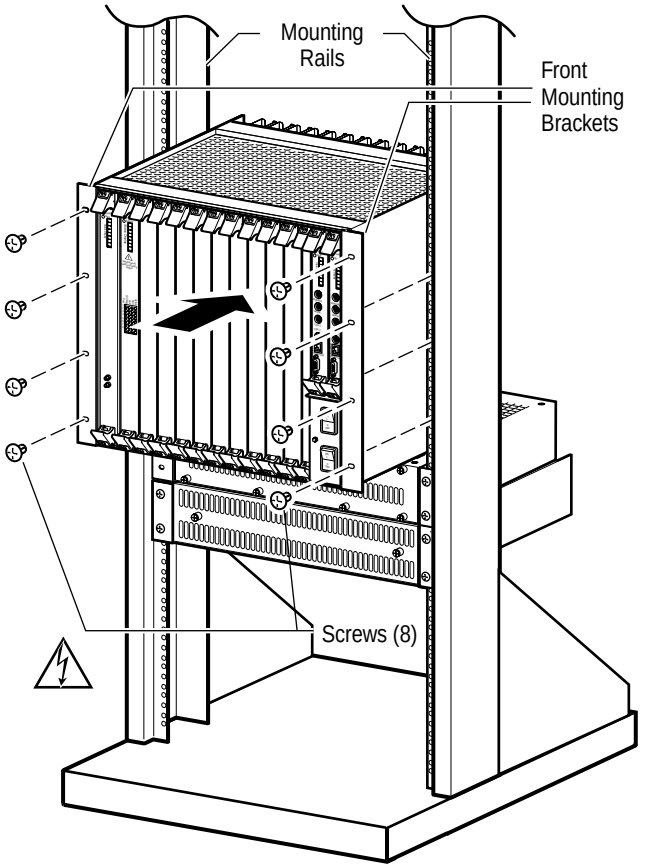


Figure 3-6 Inserting the Chassis in the Rack

6. Rest the chassis on top of the fan tray to ensure that a tight seal is made between the bottom of the chassis and the top of the fan tray.

7. While keeping the brackets flush against the mounting posts, position the chassis so that the 8 holes in the mounting brackets *(4 on each bracket)* are aligned with those in the post.

8. Insert all eight screws into the bracket holes, as shown in Figure 3-7. Using the appropriate tool, tighten all the screws so that each one goes through the bracket and into the rack-mount post. Ensure that all screws are firmly in place.

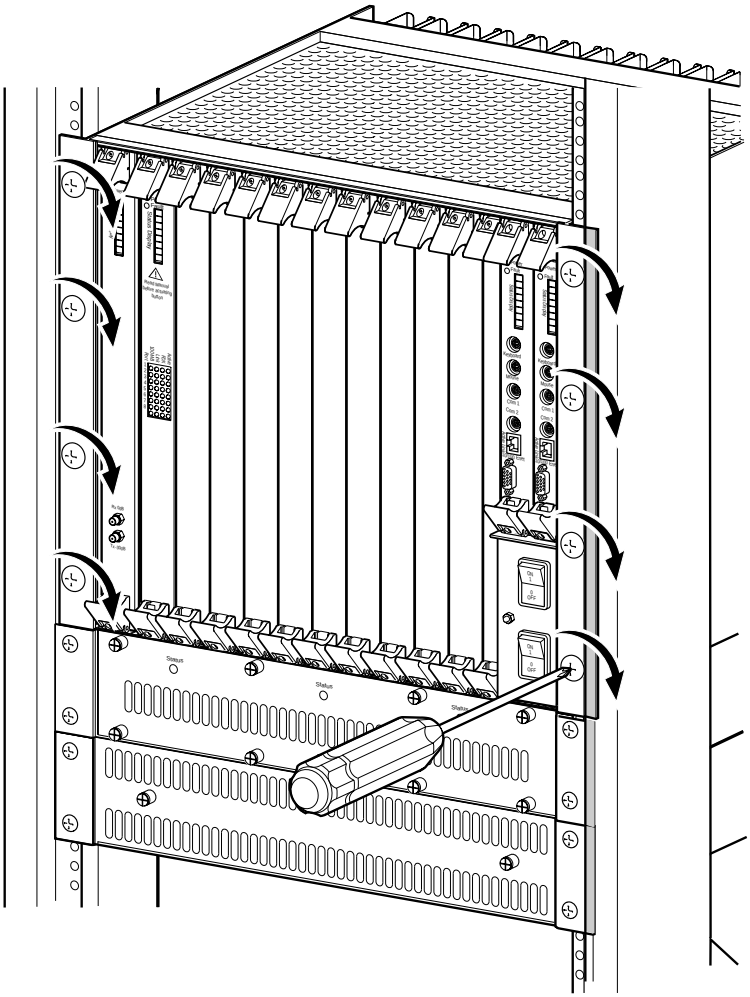


Figure 3-7 Rack-Mounting the Chassis

Rack-Mounting the Exhaust Plenum

You must mount a plenum directly above each chassis to guarantee the minimum necessary air space of 2 U's *(3.5 inches)* and ensure that adequate air flows out of the system. A plenum functioning in this capacity is referred to as an *exhaust plenum*.

For more information on the proper placement of system components in a rack, see "System Placement in the Rack" on page 64.

CAUTION: *If for any reason you are not using plenums, be sure to leave 2 U's (3.5 inches) of vertical rack space where they would normally be mounted.*

Use this procedure to rack-mount the exhaust plenum:

1. Determine the placement of the plenum in the rack as described in *"System Placement in the Rack"* on page 64.
2. Position the plenum so that the front panel is facing towards you and the side stamped "THIS SIDE UP" is facing up.
3. Insert the plenum into the rack until the front brackets on each side of the plenum meet the mounting posts, as shown in Figure 3-8.
4. Rest the plenum on top of the chassis to ensure an adequate seal between the bottom of the plenum and the top of the chassis, as shown in Figure 3-8.
5. While keeping the plenum flush against the mounting posts, position the plenum so that the 4 holes in the mounting brackets are aligned with those in the post.
6. Insert all 4 screws *(2 on each side)* into the bracket holes as shown in Figure 3-8. Use the appropriate tool to tighten all the screws so that each one goes through the bracket and into the rack-mount post.

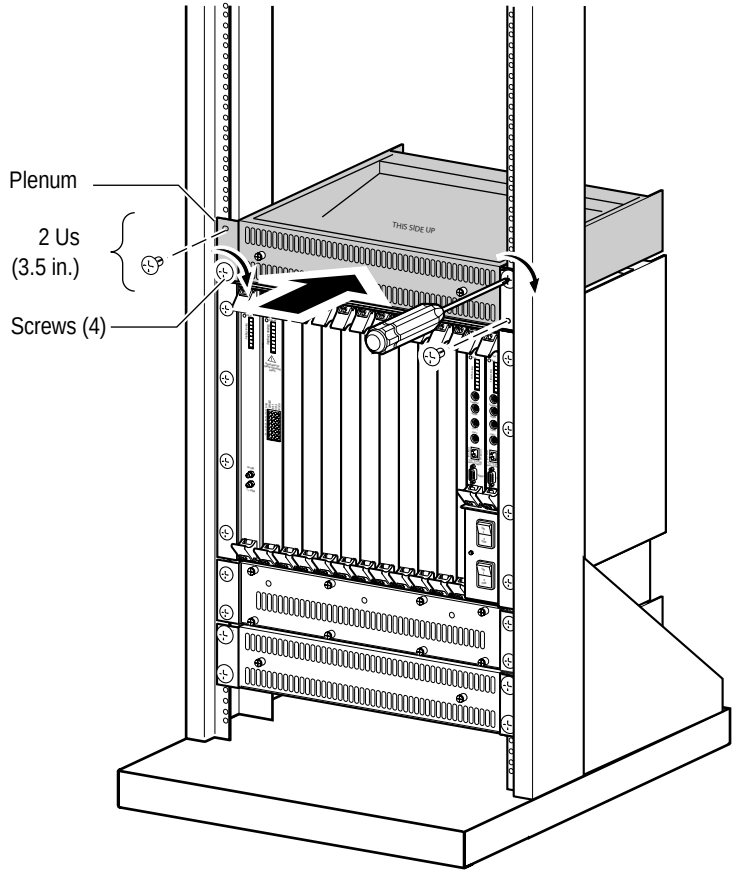


Figure 3-8 Rack-Mounting the Exhaust Plenum

4 INSTALLING MODULES

This chapter describes how to install and replace system modules in the Cuda 12000 chassis. Installing and replacing system modules involves the following steps:

- Determining Module Location
- Replacing Filler Panels and Backplates
- Installing System Modules
- Removing Modules

CAUTION: *Before proceeding with the procedures in this chapter, you should read Chapter 2, "Preparing for Installation."*

Determining Module Location

The first step in module installation is to determine an appropriate slot in which to install the module. Cuda 12000 modules are accessible from the front of the chassis.

When installing modules, you must adhere to specific board orientation restrictions based on chassis slot number. Chassis slots are numbered from 1 through 14, as shown in Figure 4-1.

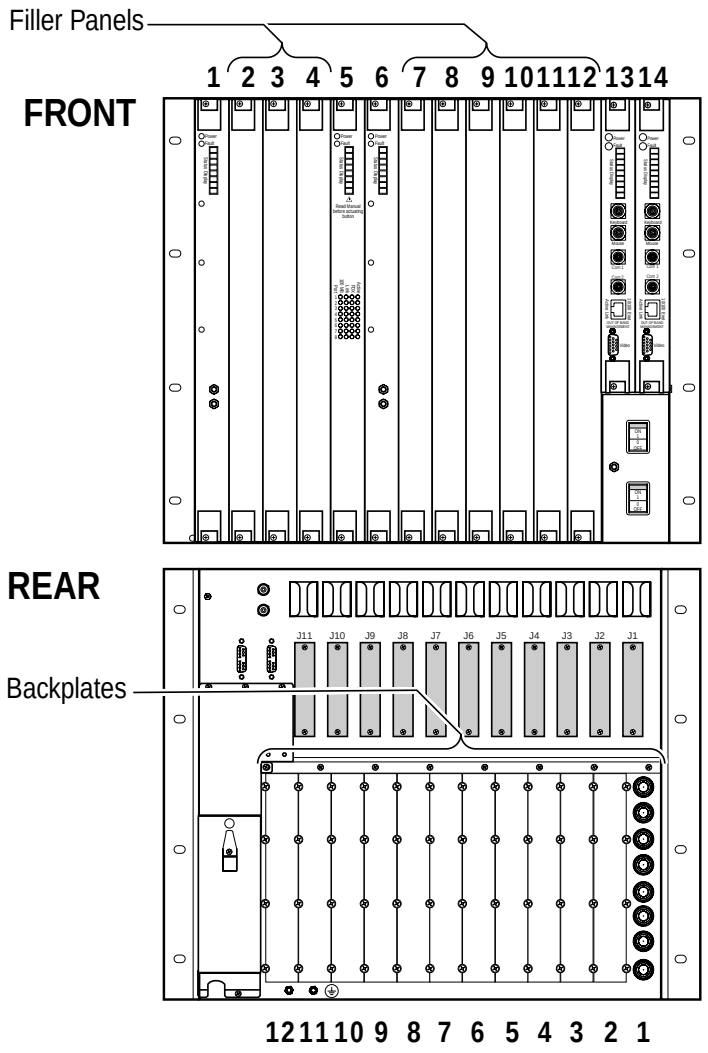


Figure 4-1 Chassis Slot Numbering

Table 4-1 identifies the module types supported by each chassis slot.

Table 4-1 Module Location Based on Slot

Slot	Modules Accepted
1	■ DOCSIS ■ EuroDOCSIS ■ 10/100 Ethernet ■ Cuda Protocol Analyzer
2– 11	■ DOCSIS ■ EuroDOCSIS ■ 10/100 Ethernet ■ POS ■ Gigabit Ethernet ■ Cuda Protocol Analyzer
12	■ DOCSIS ■ EuroDOCSIS ■ Gigabit Ethernet ■ POS ■ Cuda Protocol Analyzer
13, 14	■ Management Modules

CAUTION: *Appropriate backplates must be in place prior to installing modules.*

Replacing Filler Panels and Backplates

This section provides the replacement procedures for these items:

- **Filler Panels**: Blank aluminum faceplates that occupy unused chassis slots to ensure proper air flow over vital components.
- **Backplates**: Aluminum plates that cover the back of each chassis slot and enable *CableOnce* (blind-mate) connectivity to network modules.

Ensure that all unused chassis slots contain a filler panel and are covered by a backplate. Backplates keep dust and debris out of the chassis slot, helps maintain the cooling integrity of the system, and is required to meet FCC compliance.

Filler Panels

All unused slots must contain a filler panel. A filler panel unit consists of an aluminum board mounted with a blank faceplate. You can remove and replace these units with the power *on*. Filler panels are inserted into all unused slots from the front of the chassis and serve three primary functions:

- Maintain the cooling integrity of the system by occupying the space where a module would normally be seated, thereby directing air flow to where it is needed most. It is especially important to install filler panels in all unused slots when stacking chassis.
- Keep dust and other debris out of the chassis slot.
- Ensure FCC compliance.

You will need a #1 Phillips screwdriver to complete the following procedures. Be sure to save all filler panels for possible re-configuration of the system.

Removing a Filler Panel

To remove a filler panel:

1. Ensure that you are properly grounded by wearing an ESD protective device.
2. Loosen the two captive screws (shown in Figure 4-2) that secure the unit in the chassis.
3. Unseat the panel by moving the ejector levers to the outward position, as shown in Figure 4-2.
4. Grasp both ejector levers and gently slide the unit straight out from the chassis.

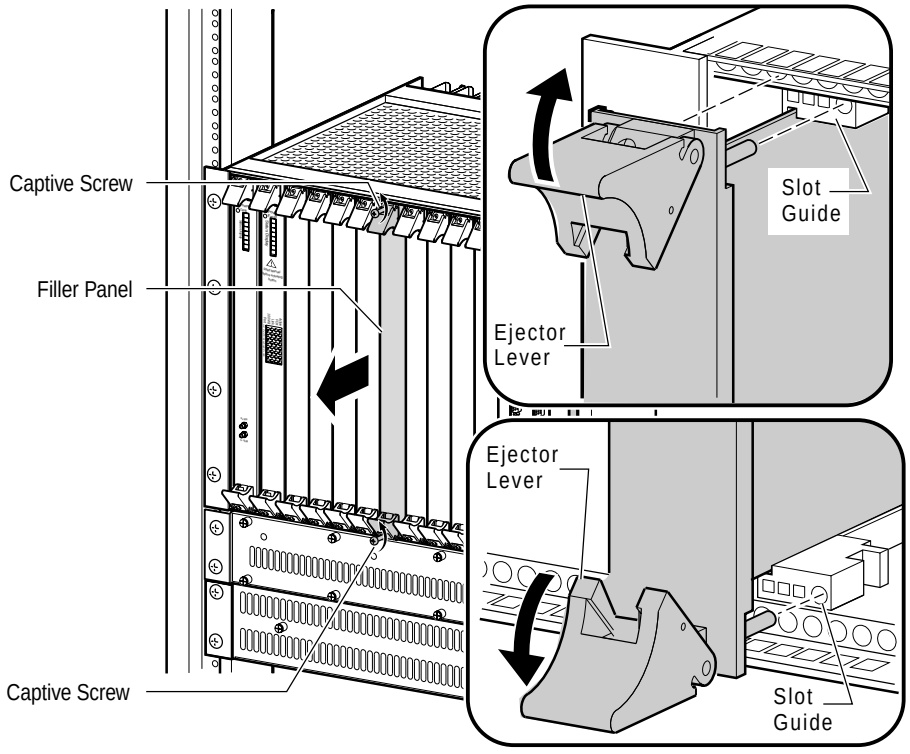


Figure 4-2 Removing a Filler Panel

Replacing a Filler Panel

To replace a unit:

1. Ensure that you are properly grounded by wearing an ESD protective device.
2. Standing in front of the chassis, align the filler panel with the selected slot, then insert the top and bottom edges of the filler panel into the slot guides, as shown in Figure 4-3.

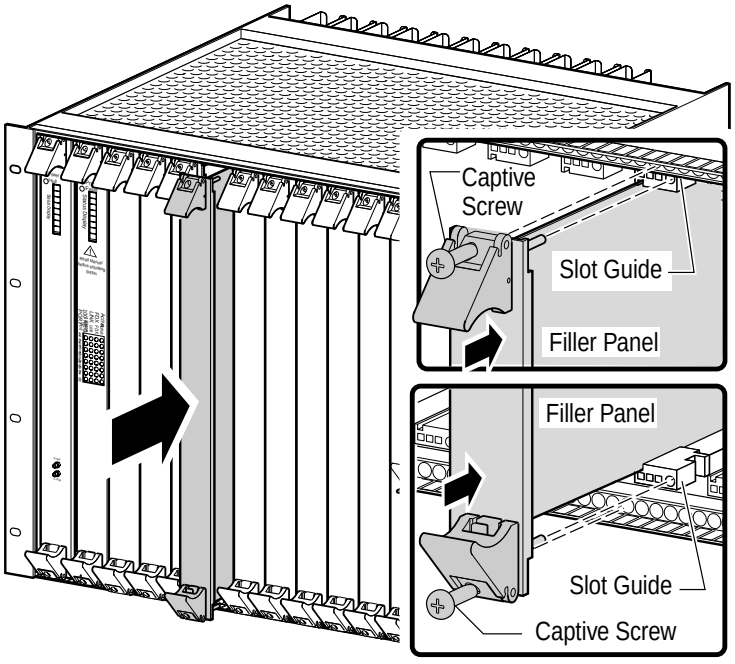


Figure 4-3 Inserting the Filler Panel

3. Slide the filler panel along the slot guides and into the chassis until the faceplate meets the chassis.
4. Secure the filler panel in place with the two captive screws, as shown in Figure 4-4.

CAUTION: *Be sure not to over tighten the screws.*

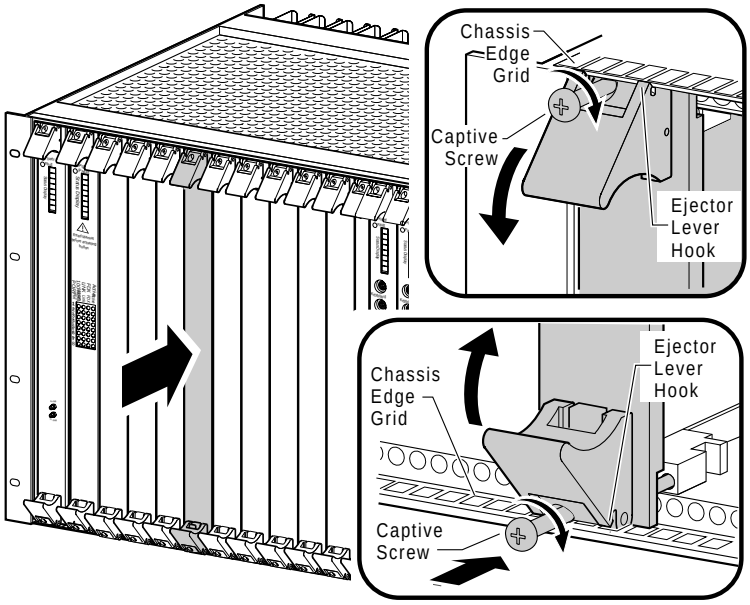


Figure 4-4 Securing the Filler Panel

Backplates

Your system uses three types of slot backplates, accessible from the rear of the chassis:

- **Blank Backplates:** Used as follows:
  - To cover all unused chassis slots.
  - To cover slots in which 10/100 Ethernet modules reside. Covering Ethernet slots is necessary because connection to a 10/100 Ethernet module is achieved through the RJ-21 Champ connectors fixed on the rear of the chassis for each slot, 1 through 11.
- **DOCSIS Module Backplates**: Used to connect to all DOCSIS and EuroDOCSIS modules that reside in chassis slots 2 through 12.
- **Fiber Module Backplates**: Used to connect Gigabit Ethernet and POS modules that reside in slots 2 through 12.

Slot 1 is shipped DOCSIS/EuroDOCSIS ready with a permanently fixed DOCSIS module backplate attached to the back of the slot. Note that you cannot install fiber modules in slot 1.

Figure 4-5 shows the three types of removable backplates that the Cuda 12000 uses.

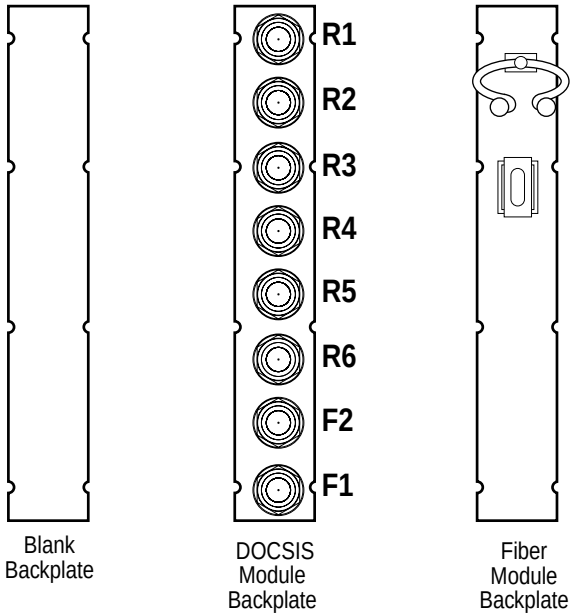


Figure 4-5 Cuda 12000 Removable Backplates

If you are installing a DOCSIS or EuroDOCSIS module in any slot, 2 through 12, you must first install a DOCSIS module backplate on the back of the selected slot.

Slot 1 comes DOCSIS/EuroDOCSIS ready. Slot 1 has a permanently fixed DOCSIS module backplate mounted with eight F-type connectors. Table 4-2 shows the upstream and downstream ports used for each CMTS module.

Table 4-2 DOCSIS/EuroDOCSIS Module Ports

CMTS Module	Upstream Ports	Downstream Ports
1x4 DOCSIS	R1 - R4	F1
1x4 DOCSIS SpectraFlow	R1 - R4	F1
1x6 DOCSIS SpectraFlow with Spectrum Management	R1 - R6	F1 & F2
1x4 EuroDOCSIS	R1 - R4	F1
1x4 EuroDOCSIS SpectraFlow	R1 - R4	F1
1x4 EuroDOCSIS SpectraFlow with Spectrum Management	R1 - R4	F1 & F2

Octal 10/100 Ethernet modules connect to the network through RJ-21 ports mounted on the back of the chassis and do not use a removable backplate for connection to the network.

You will need a #1 Phillips screwdriver to complete these procedures. Be sure to save all backplates for possible re-configuration of the system.

You can use the following procedures to remove any backplate for slots 2 through 12. Note that chassis slots 13 and 14 are reserved for Management modules and do not utilize removable backplates.

Removing a Backplate

To remove a backplate:

1. Remove the eight screws (four on each side) that secure the backplate to the chassis.
2. Remove the backplate from the chassis, as shown in Figure 4-6.

Replacing a Backplate

To replace a backplate:

1. From the rear of the chassis, place the backplate over the open slot. Align the four notches on either side of the backplate with the holes in the chassis. *If you are installing a DOCSIS module backplate*, position the backplate so that the downstream port, labelled **F1**, is at the bottom, as shown in Figure 4-6.
2. While holding the backplate in position against the chassis, insert and tighten the eight screws to secure the backplate in place. Figure 4-6 shows the installation of a DOCSIS module, fiber module, and blank backplate.

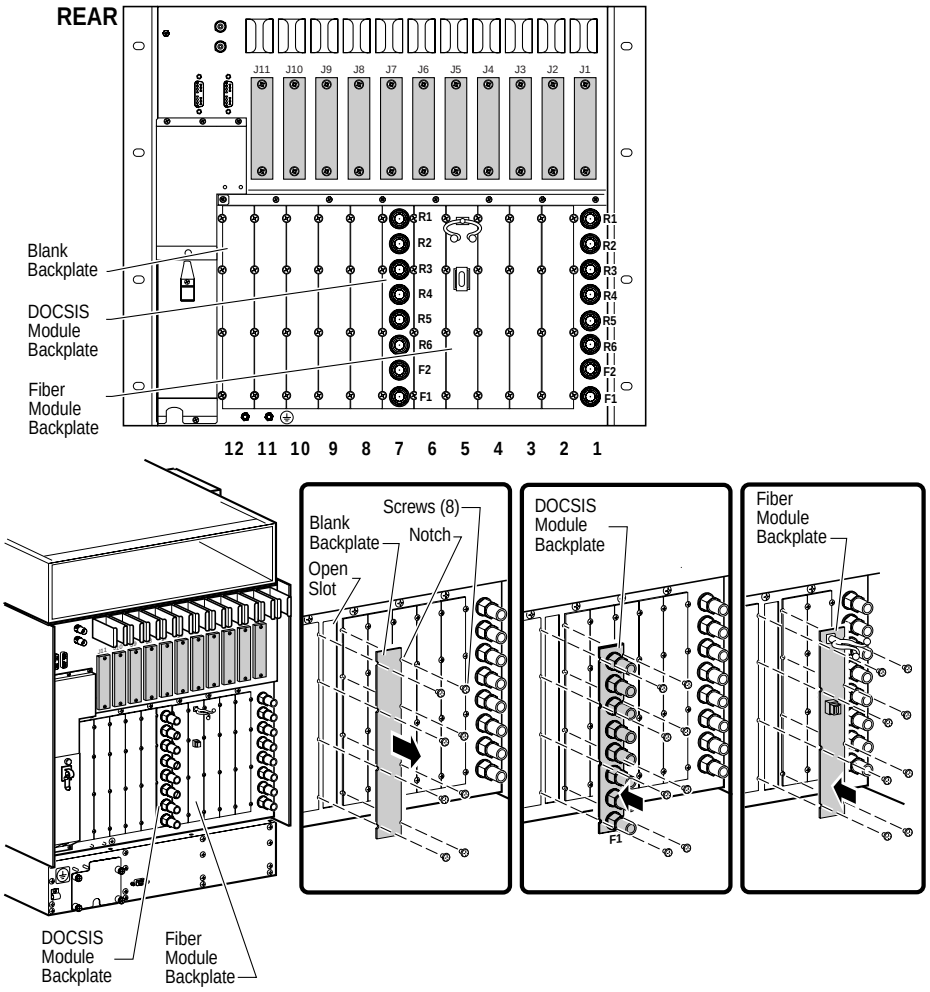


Figure 4-6 Replacing Backplates

Installing System Modules

This section describes how to install system modules in the Cuda 12000 chassis. All system modules have ejector levers and require the same installation process. All modules are hot-swappable; you can remove and replace modules while the system is operating without interruption to other modules in the same system.

Before you begin this procedure, be sure to read Chapter 2, *"Preparing for Installation"* and review these sections:

- *"Determining Module Location"* on page 77
- *"Replacing Filler Panels and Backplates"* on page 79

CAUTION: *Electrostatic Discharge (ESD) can damage module components, causing complete or intermittent failures in operation. ESD can occur when a module is improperly handled.*

To prevent ESD damage to a system module:

- *Always wear an ESD grounding device, such as an ESD wrist strap, when handling the module. The chassis offers two jacks for this purpose: a single ESD grounding jack on the front power switch panel, and a single jack in the upper left corner of the rear chassis panel.*
- *Do not remove the module from its antistatic bag until you are ready to install it.*
- *Handle the module by its edges to avoid touching any pins, leads, or solder connections on the circuit board.*

You need a #1 Phillips screwdriver to install a system module in the chassis.

To install a system module in the chassis:

1. Ensure that you are properly grounded by wearing an ESD protective device.
2. Choose the slot in which you want to install the module. See Table 4-1 on page 79 for instructions on determining the appropriate slot for each module type.
3. If you are installing a Gigabit Ethernet module, POS module, or DOCSIS/EuroDOCSIS module, ensure that you have installed the appropriate backplate, as described in *"Backplates"*on page 83.

4. If you haven't already done so, remove the filler panel from the selected slot. For more information about removing filler panels, see *"Filler Panels"* on page 80.

5. Remove the module from its shielded, antistatic bag. Standing in front of the chassis, position the module vertically so that the faceplate (front) is toward you and the LED message display is at the top. Align the module with the selected slot as shown in Figure 4-7.

CAUTION: *Always insert the module carefully, to ensure that the board components on the module that you are installing do not scrape against the adjacent faceplates.*

6. Insert the module edges in the upper and lower slot guides and slide the module midway into the slot. Move the levers to the outward position, as shown in Figure 4-7.

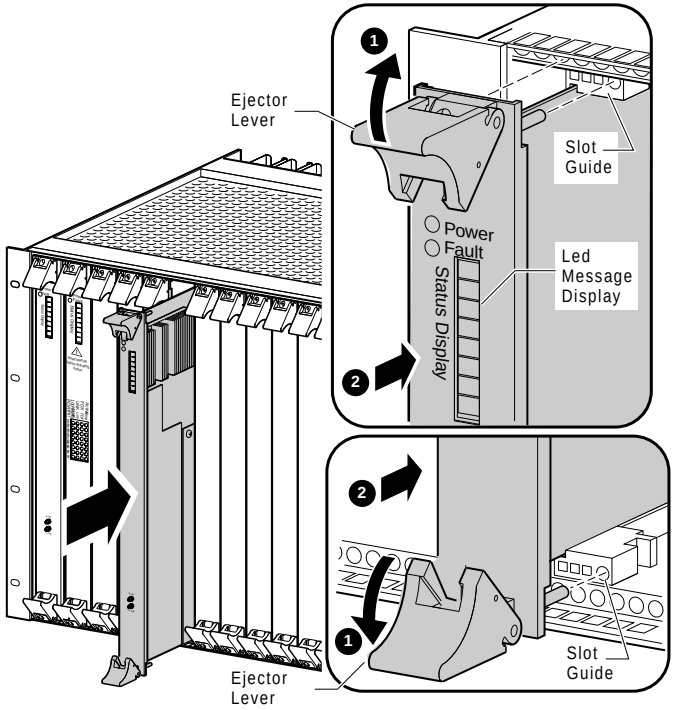


Figure 4-7 Inserting the Module

7. With the ejector levers still in the outward position, apply pressure to the center of the module face plate, and gently slide the module along the guides and into the slot until you feel it firmly meet the backplane.

8. Move the ejector levers to the inward position (Figure 4-8) until you feel them lock into place. The ejector lever hooks must catch the holes in the chassis edge grid, as shown in Figure 4-8; this action locks the module in place. As you move the ejectors to the inward position, you should feel the module connectors engage the backplane connectors as the module seats firmly in place.
9. With the module fully inserted, and the ejector levers locked in the inward position, secure the module in place with the captive screws, as shown in Figure 4-8.

CAUTION: *Be sure not to over-tighten the screws.*

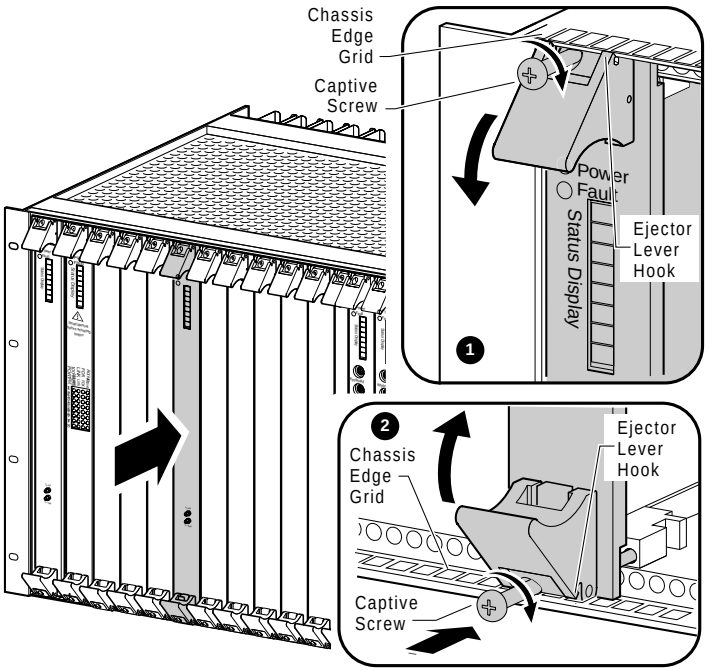


Figure 4-8 Seating and Securing the Module

Repeat the above steps for any remaining system modules that you want to install.

Removing Modules

This section describes how to remove system modules from the Cuda 12000 chassis. All system modules have ejector levers and require the same removal process. You can use the procedure in this section to remove all Cuda 12000 Management modules. These modules are hot-swappable; you can remove and replace modules with the power on.

CAUTION: *To prevent damage to the system, be sure that you are properly grounded with an ESD protection device before beginning this procedure. Be sure to have a shielded antistatic bag available in which to store the module.*

You need a #1 Phillips screwdriver to remove a system module from the chassis.

To remove a system module from the chassis:

1. Ensure that you are properly grounded by wearing an ESD protective device.
2. Loosen the two captive screws that secure the module in place, as shown in Figure 4-9.
3. Release the module from the backplane by moving the levers to the outward position, as shown in Figure 4-9. As you move the levers to the outward position, you should feel the module connectors release from the backplane connectors.
4. Grasp the ejector levers and pull the module out of the slot.
5. Do one of the following to ensure that the slot does not remain open *(empty)*:
   - Install another module in the slot, as described in *"Installing System Modules"* on page 87.
   - If you are not installing another module in the slot, install a filler panel into the empty slot, as described in *"Filler Panels"* on page 80.

CAUTION: *Always remove the module carefully to ensure that the board components on the module that you are installing do not scrape against the adjacent faceplates.*

After removing the module, be sure to store the module in an anti-static bag.

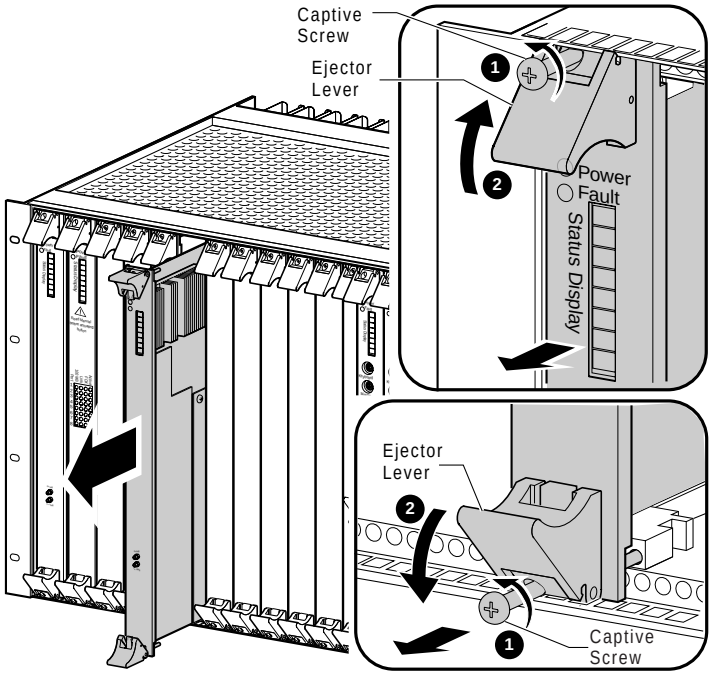


Figure 4-9 Releasing Module from Backplane

6. Repeat the above steps for any remaining system modules that you want to remove.

5 CABLING THE SYSTEM

Your cabling tasks depend on the physical configuration of your system. This chapter describes how to cable the Cuda 12000 and includes:

- Cabling the Management Module
- Cabling DOCSIS and EuroDOCSIS Modules
- Cabling Octal 10/100 Ethernet SpectraFlow Modules
- Cabling Gigabit Ethernet SpectraFlow and POS SpectraFlow Modules
- Connecting Power
- Cabling for System Fault Reporting

CAUTION: Before proceeding with the procedures in this chapter, read Chapter 2, *"Preparing for Installation."*

Cabling the Management Module

The Cuda 12000 Management module supports these forms of access:

Serial Access	COM ports on the front of the management module provide serial access to the system. Using an ADC-provided serial cable, you can use COM 1 or COM 2 to access the system locally using a terminal emulation program, such as HyperTerminal, or for remote modem access. See *"Cabling for Serial Access,"* next for instructions on how to cable the COM ports.
Network Access	The 10/100 Ethernet Craft port located on the front of the Management module provides both Telnet and Web access to the system. See *"Cabling for Network Access"* on page 98 for instructions on how to cable the Craft port.

Cabling for Serial Access

Initial access to the Cuda 12000 is achieved through either of the COM ports located on the front of the Management module. You must first access the system through these COM ports to assign an IP address to the Craft port and configure the system for network access.

Both COM port 1 and COM port 2 provide serial access to the system. The advantage to this form of direct access is that you do not loose your connection to the system upon reboot. Both COM port 1 and COM port 2 can be cabled for either terminal or modem access.

Connection to these COM ports are achieved through these ADC-provided serial cables:

Terminal Access Cable	This 10-foot serial cable consists of an 8-pin Mini DIN connector on one end; a 9-pin female DSub on the other.
Modem Access Cable	This 10-foot serial cable consists of an 8-pin Mini DIN connector on one end; a 25-pin male DSub on the other.

Refer to Appendix C for serial access cabling wiring diagrams.

Cabling COM 1 for Terminal Access

The Management module supports local *(serial)* access through the COM 1 port located on the front of the Management module. You can use the ADC-provided serial cable to attach a COM server, terminal emulator, or a PC running a terminal emulation program to this port to access the command line interface.

To cable the Management module for local access, have the terminal access serial cable at hand and use the following procedure:

1. Insert the 8-pin Mini-DIN connector on one end of the cable into the COM 1 port located on the front of the Management module.
2. Attach the DB-9 connector on the other end of the cable to a COM server, or a system running a terminal emulation program.

Figure 5-1 shows the cabling of COM port 1 for terminal access:

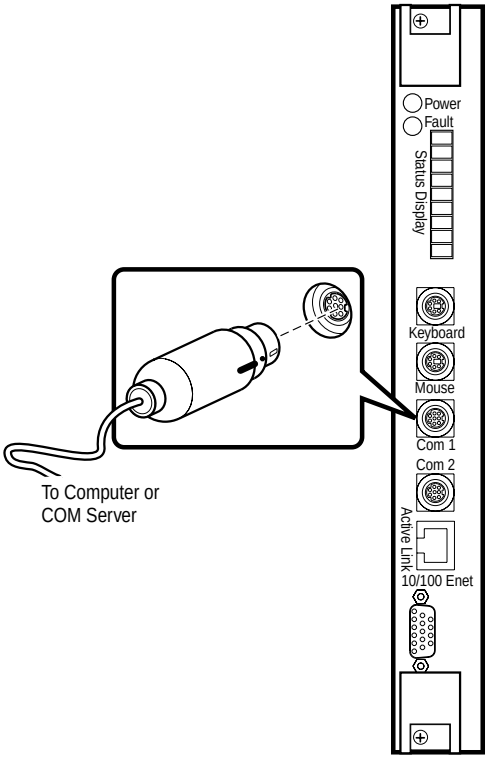


Figure 5-1 Cabling COM 1 for Terminal Access

Cabling COM 1 for Modem Access

The Management module also supports modem access through COM 1 located on the front of the Management module. Connection is achieved using an ADC-provided modem access serial cable. This setup provides dial-up access to the command line interface.

To cable the Management module for modem access, have the modem access serial cable at hand and use the following procedure:

1. Insert the 8-pin Mini-DIN connector on one end of the cable into COM 1 located on the front of the Management module.
2. Attach the DB-25 connector on the other end of the cable to the serial port on the modem.You can then dial into the modem to access the Cuda 12000 management system.

Figure 5-2 shows the cabling of COM port 1 for modem access:

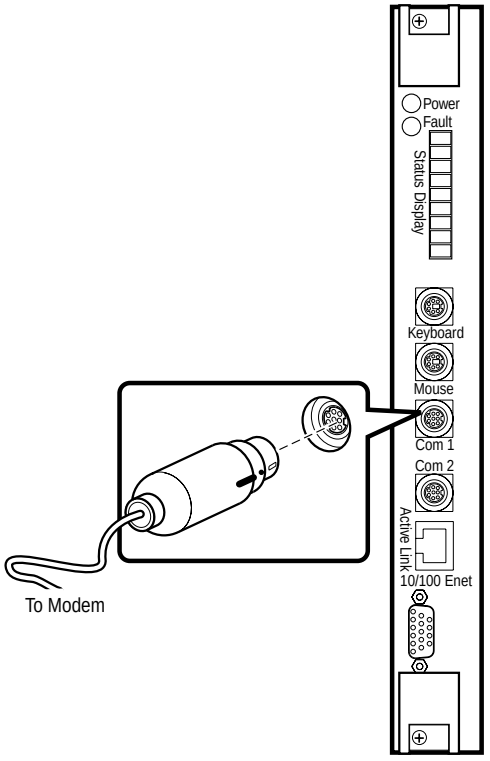


Figure 5-2 Cabling COM 1 for Modem Access

Cabling COM 2 for Terminal Access

The Management module also supports local *(serial)* access through the COM 2 port located on the front of the Management module. You can use the ADC-provided serial cable to attach a COM server, terminal emulator, or a PC running a terminal emulation program to this port to access the command line interface.

To cable the Management module for local access, have the terminal access serial cable at hand and use the following procedure:

1. Insert the 8-pin Mini-DIN connector on one end of the cable into the COM 2 port located on the front of the Management module.
2. Attach the DB-9 connector on the other end of the cable to a COM server, or a system running a terminal emulation program.

Figure 5-3 shows the cabling of COM port 2 for terminal access:

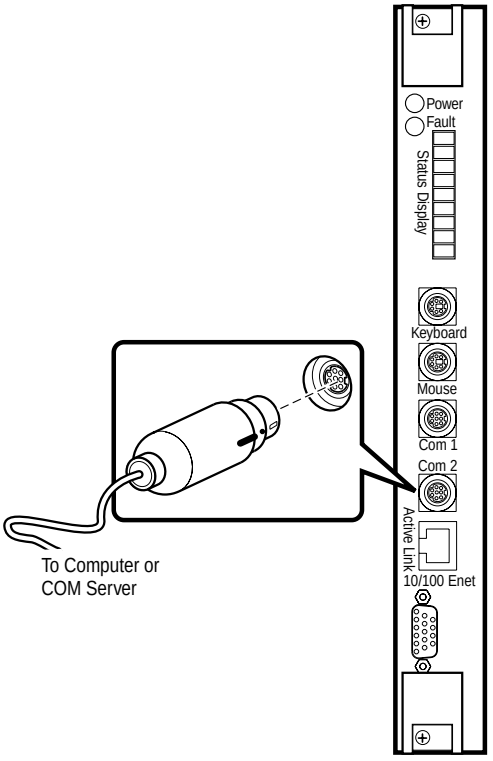


Figure 5-3 Cabling COM 2 for Terminal Access

Cabling COM 2 for Modem Access

The Management module also supports modem access through COM 2 located on the front of the Management module. Connection is achieved using an ADC-provided modem access serial cable. This setup provides dial-up access to the command line interface.

To cable the Management module for modem access, have the modem access serial cable at hand and use the following procedure:

1. Insert the 8-pin Mini-DIN connector on one end of the cable into COM 2 located on the front of the Management module.
2. Attach the DB-25 connector on the other end of the cable to the serial port on the modem.You can then dial into the modem to access the Cuda 12000 management system.

Figure 5-4 shows the cabling of COM port 2 for modem access:

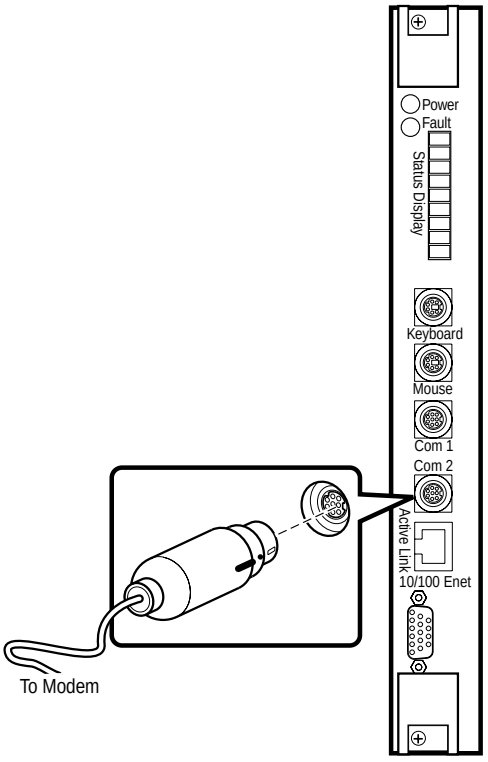


Figure 5-4 Cabling COM 2 for Modem Access

Cabling for Network Access

The 10/100BASE–TX CRAFT management interface uses an RJ-45 connector and provides a 10/100 Mbps Ethernet connection over UTP-Category 5 copper wire. To gain command line interface (CLI) management access to the system, Telnet directly into the Management module through this port. If you have installed CudaView (graphical user interface software), you can point your Web browser to the address assigned to this port to gain Web-based management access. Refer to the *Cuda 12000 IP Access Switch CLI-based*

Administration Guide or the *Cuda 12000 IP Access Switch CudaView Administration Guide* for more information on gaining access to the system.

To cable the CRAFT management interface.

1. Insert the RJ-45 connector on the 10/100BASE-TX cable into the CRAFT management port until it clicks into place.
2. Connect the other end of the 10/100BASE-T cable to the MDI port on the network device to which you want to connect.

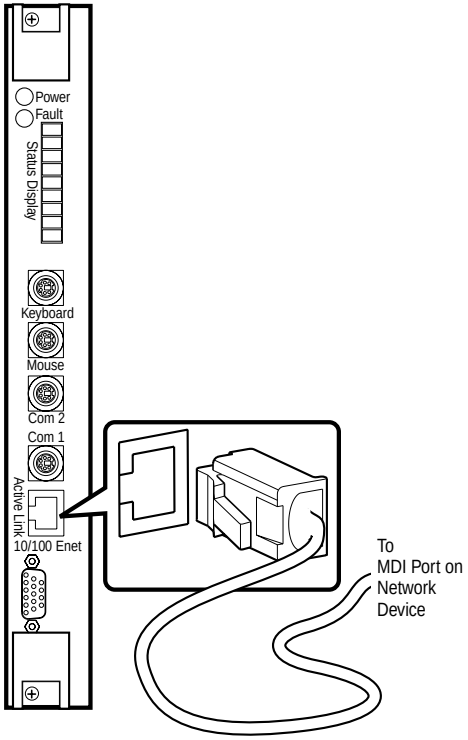


Figure 5-5 Cabling the CRAFT Management Interface

Cabling DOCSIS and EuroDOCSIS Modules

The system supports a *CableOnce* (blind-mate) setup for DOCSIS and EuroDOCSIS modules. Instead of cabling directly to the module, attach the cables to the F connectors on the CMTS backplate that covers the back of the slot. This means that once you cable the RF downstream port(s) and the RF upstream ports for a particular slot, you can remove and replace DOCSIS and EuroDOCSIS modules within that slot without having to recable them; the cables remain fixed to the backplate.

If you have a module(s) in the chassis that is powered on and active, make sure that the module is configured.

Before cabling a DOCSIS/EuroDOCSIS module to your cable plant, you should configure the downstream ports with a frequency and power output appropriate to your cable plant. If you have not done so, ensure that the downstream port status is set to `down`. For information on how to configure DOCSIS/EuroDOCSIS modules, see the *Cuda 12000 IP Access Switch CLI-based Administration Guide* and the *Cuda 12000 IP Access Switch CudaView Administration Guide.*

The procedure in this section assumes:

- You have already selected the slot in which to install the DOCSIS or EuroDOCSIS module, as described in *"Determining Module Location"* on page 77.
- If necessary, you have already installed the CMTS backplate on the back of the selected slot as described in *"Backplates"* on page 83.

Slot one consists of a permanently fixed CMTS backplate and is shipped DOCSIS/EuroDOCSIS ready. If you are installing a DOCSIS or EuroDOCSIS module in any other slot, you must first install a CMTS backplate onto the back of the slot.

Do not tighten the backplate RF connectors up against the backplates themselves. It is important that the chassis interface is permitted to float to allow the module connectors to be inserted properly. The torque specification for the nut that tightens the backplate RF connector to the backplate is 8 in-lb.

The ports on DOCSIS and EuroDOCSIS modules use high performance RF connectors. Using a cable with a male connector of incorrect dimensions may cause physical damage. The center conductor diameter must be less than 34 mil (.85mm) and shorter than 125 mil (3.1mm) measuring from the edge of the connector.

To cable a slot for DOCSIS/EuroDOCSIS module operation:

1. Attach the upstream coaxial cables to the upstream F connectors located on the CMTS backplate, as shown in Figure 5-6. Upstream connectors are labelled R1-R6 on the backplate. If you are cabling slot 1, the upstream connectors are the first 6 ports counting down from the top of the backplate. The torque specification for attaching a coaxial cable to the F connector is 30 in-lb.
2. Ensure that the other end of the upstream cables that you have connected are properly attached to the HFC network.
3. Attach the downstream coaxial cable to the downstream F connector(s) on the CMTS backplate, as shown in Figure 5-6. The torque specification for attaching a coaxial cable to the F connector is 30 in-lb.
4. Ensure that the other end of the downstream cable is properly attached to the HFC network.

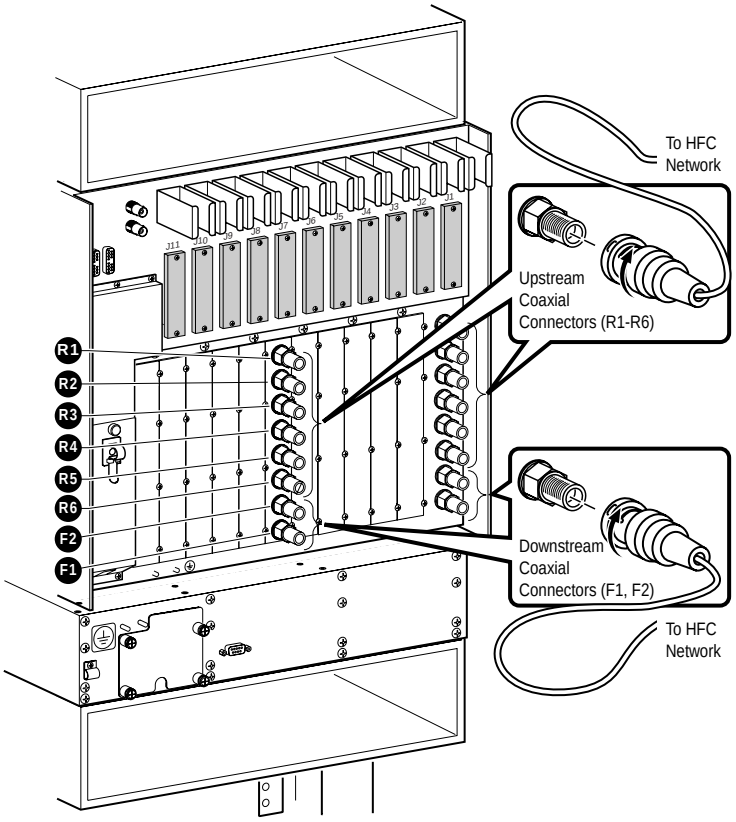


Figure 5-6 Cabling the DOCSIS/EuroDOCSIS Module

Cabling Octal 10/100 Ethernet SpectraFlow Modules

The system supports a *CableOnce* (blind-mate) setup for Octal 10/100BASE-TX modules. Connection to the 10/100 Ethernet network is achieved through RJ-21 Champ connectors fixed on the rear chassis panel for slots 1 through 11. Because you cable the slot and not the module itself, you can remove and replace a 10/100 Ethernet module in the selected slot without having to recable it.

Slot 12 does not support 10/100 Ethernet modules.

To cable a 10/100 Ethernet module slot to a Cat 5 Ethernet patch panel. follow this procedure:

1. Locate the slot that you have installed, or want to install, the 10/100 Ethernet module. Then locate the RJ-21 port for the selected slot on the back of the chassis. The RJ-21 ports located on the back of the chassis are numbered right-to-left, from J1–J11, as shown in Figure 5-7.
2. If you haven't already done so, unscrew and remove the RJ-21 metal dust cover, as shown in Figure 5-7.
3. Insert the male RJ-21 connector on the Cat 5 patch cable into the RJ-21 port for the selected slot, as shown in Figure 5-7.
4. Tighten the retaining screws on the connector to secure the cable to the chassis.

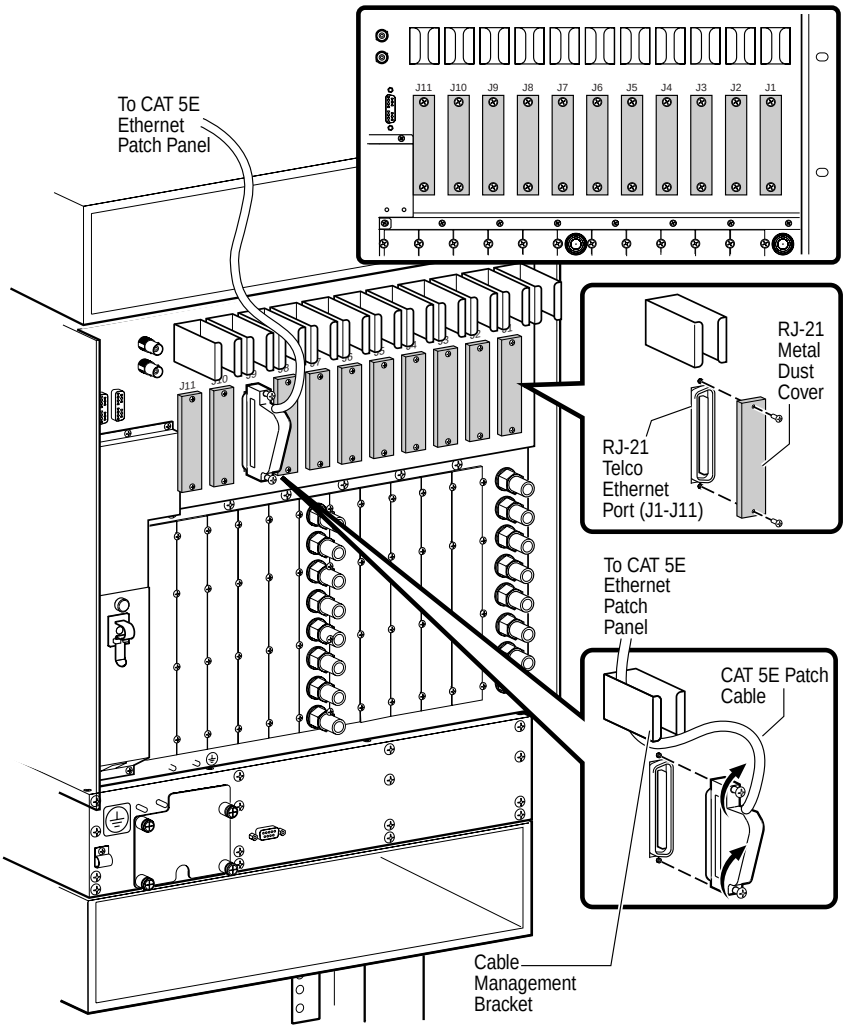


Figure 5-7 Cabling the 10/100 Ethernet Connection

5. Insert the RJ-21 connector on the other end of the cable into the appropriate port on the Cat 5 10/100 Ethernet patch panel.
6. Tighten the retaining screws on the connector to secure the cable to the panel.
7. Repeat steps 1 through 6 for another slot that you want to cable for 10/100 Ethernet operation.

For example, Figure 5-8 shows the proper cabling of chassis slot 9 for a 10/100 Ethernet module.

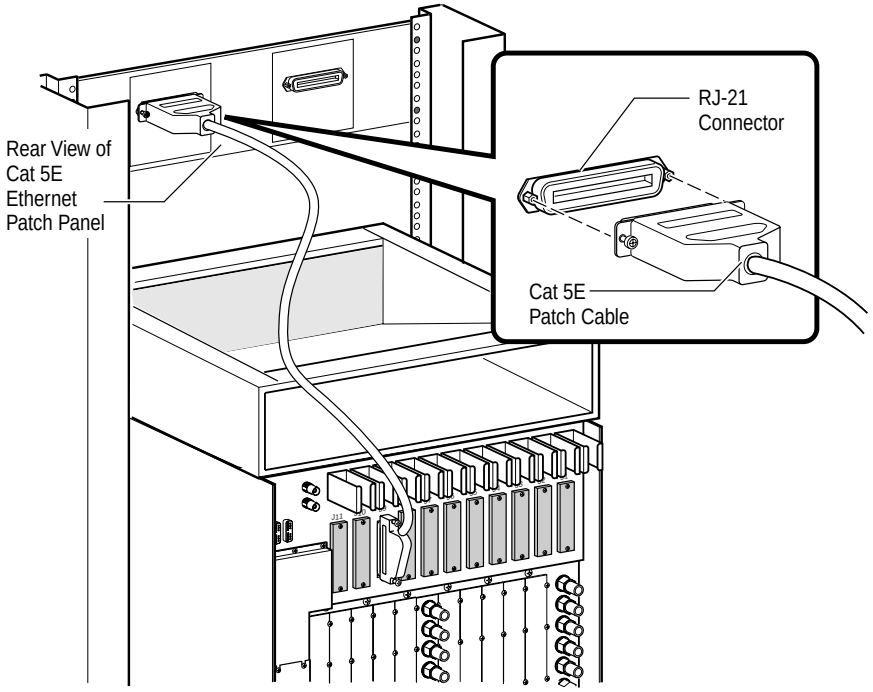


Figure 5-8 Cabling a 10/100 Ethernet Slot

To cable a Cat 5 Ethernet patch panel to your network, follow this procedure:

1. Locate the group of RJ-45 ports on the front of the patch panel that correspond to the RJ-21 connector that you installed on the back of the panel, as shown in Figure 5-8.
2. Insert the RJ-45 connector from an Ethernet patch cable into one of the RJ-45 ports located in step 1.
3. Connect the other end of the Ethernet patch cable to your network.
4. Repeat steps 1 through 3 for all Ethernet ports that you want to connect to your network.

Figure 5-9 shows the cabling of Ethernet patch panel port 5 to a network.

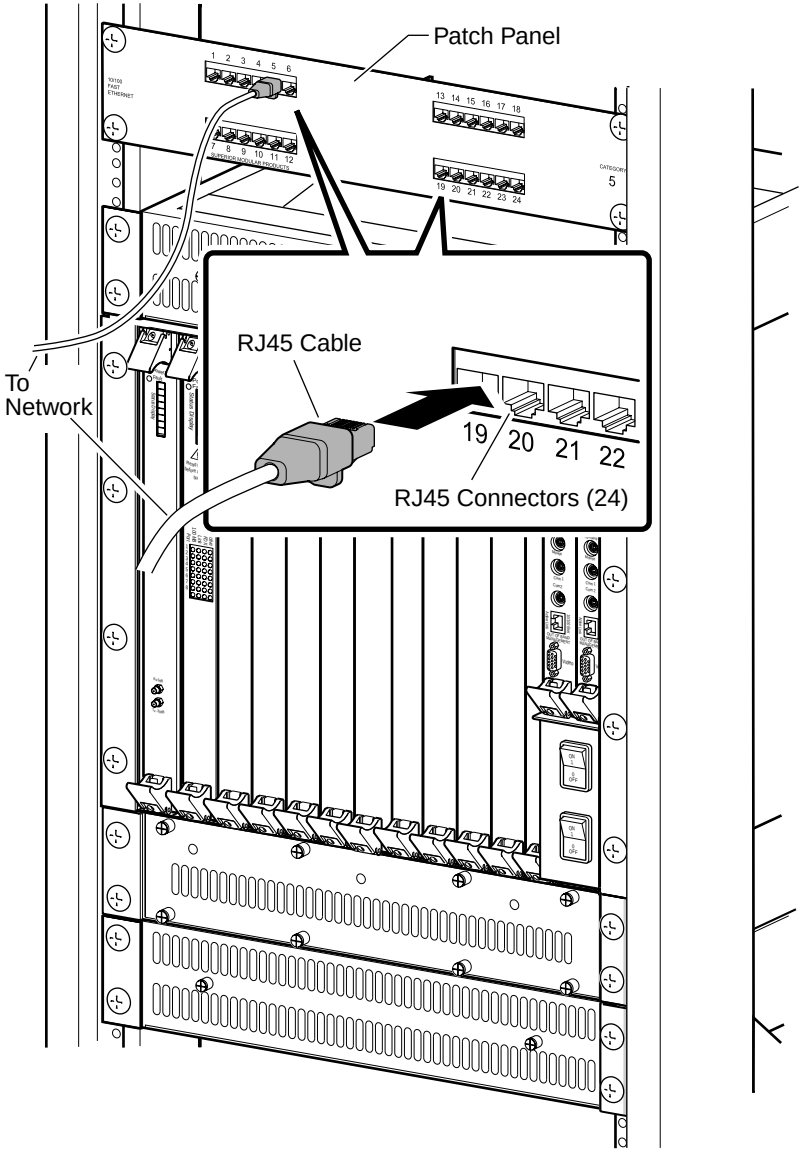


Figure 5-9 Cabling the Ethernet Ports to Network

Cabling Gigabit Ethernet SpectraFlow and POS SpectraFlow Modules

The system supports a *CableOnce* setup for fiber modules, including the Gigabit Ethernet module, and all POS modules. Instead of cabling directly to the module, attach the cable to the fiber module backplate that contains a single blind-mate fiber port. This allows you to remove and replace the module without having to recable it.

The cabling procedure for both Gigabit Ethernet and POS modules are the same. Both require installation of a fiber module backplate and use a cable provided by ADC to connect to the network.

The procedure in this section assumes:

- You have selected the slot in which to install the Gigabit Ethernet or POS module, as described in *"Determining Module Location"* on page 77.
- You have installed a fiber module backplate on the back of the selected slot as described in *"Backplates"* on page 83.

Slot 1 does not accept Gigabit Ethernet or POS modules.

Use the following procedure to cable a slot for connection to a POS or Gigabit Ethernet module:

1. Insert the AMP MPX connector on the fiber cable into the single port on the fiber module backplate, as shown in Figure 5-10.

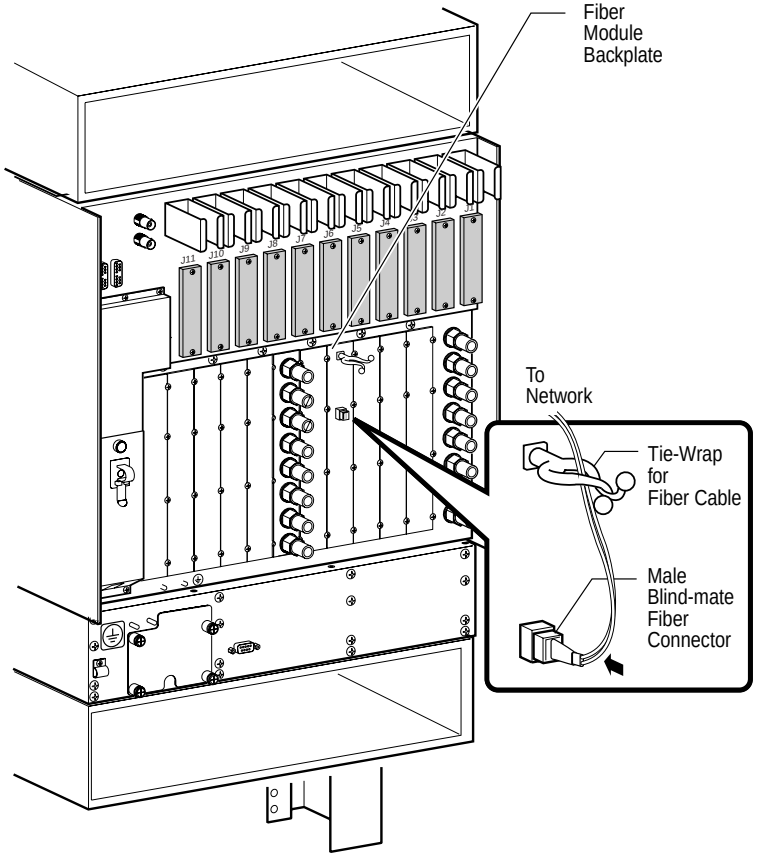


Figure 5-10 Cabling Fiber Modules

2. Attach the duplex SC connectors on the other end of the cable to the network device to which you want to connect.

Repeat steps 1 and 2 for all slots that you want to cable for fiber module operation.

Note that the ADC cable provided for fiber module connections utilizes duplex SC connectors. If the network device to which you are connecting does not use SC connectors, you must use an appropriate adapter to make the fiber connection.

Connecting Power

This section provides safety information and procedures for connecting your Cuda 12000 to power sources. You must wire power sources to both the chassis and fan tray assembly independently. Both the chassis and fan tray can support connections to two separate power sources. Redundant power sources ensure that power to the system continues uninterrupted in the event that one power source fails.

The system *(full chassis and single fan tray)* supports a maximum power consumption of 1100W and supports connection to two DC -48V (-42 to -68 VDC) power sources.

Consider the following when cabling power:

- ADC recommends that you wire the chassis and fan tray to the same power source. This is to reduce the risk of creating a condition in which the chassis operates while the fan tray does not provide cooling.
- Both the chassis and the fan tray support connection to two power sources, referred to as power sources A and B. ADC recommends that you utilize both A and B power sources for increased fault tolerance. In this suggested setup, power source A connectors from both the fan tray and chassis are connected to a single power source; power source B connectors from both the fan tray and chassis are connected to another power source.

Connecting Power to the Chassis

Your system supports connection to redundant power sources. Use 10 gauge electrical wire to connect the power sources to the chassis. Use the procedure below to connect the power sources to the system:

WARNING: Before cabling system power, you must review, understand, and follow these guidelines and precautions:

- Before you connect the power sources to the system, be sure that the circuit to which you are connecting the system is off so that all power is removed from the circuit and the wires that you are connecting.
- Before proceeding with connecting the power, ensure that both power switches on the chassis are in the off position.
- Take care not to overload the power supply circuit to which you are connecting the system.
- Before proceeding with connecting the power lines to the system, remove all jewelry such as rings, watches, and necklaces.
- Do not work alone whenever potentially hazardous conditions exist.
- Before beginning the power cabling procedure, locate the emergency power-off switch for the location in which you are working.
- Before proceeding with connecting the power lines to the system, check your work area for possible hazards such as ungrounded power extension cables and moist floors.

You need a 7/16" wrench or socket and a No. 1 phillips screwdriver to connect power to the chassis.

It is very important not to overtighten the nut to the grounding stud. Use a torque specification of 25 - 30 in-lb when tightening the nut to the grounding stud.

1. If you haven't already done so, review *"Electrical Safety Guidelines and Precautions"* on page 59.
2. Earth ground the chassis by connecting the ground wire to the two grounding terminals located on the back of the chassis using the anti-rotational lug, as shown in Figure 5-11.

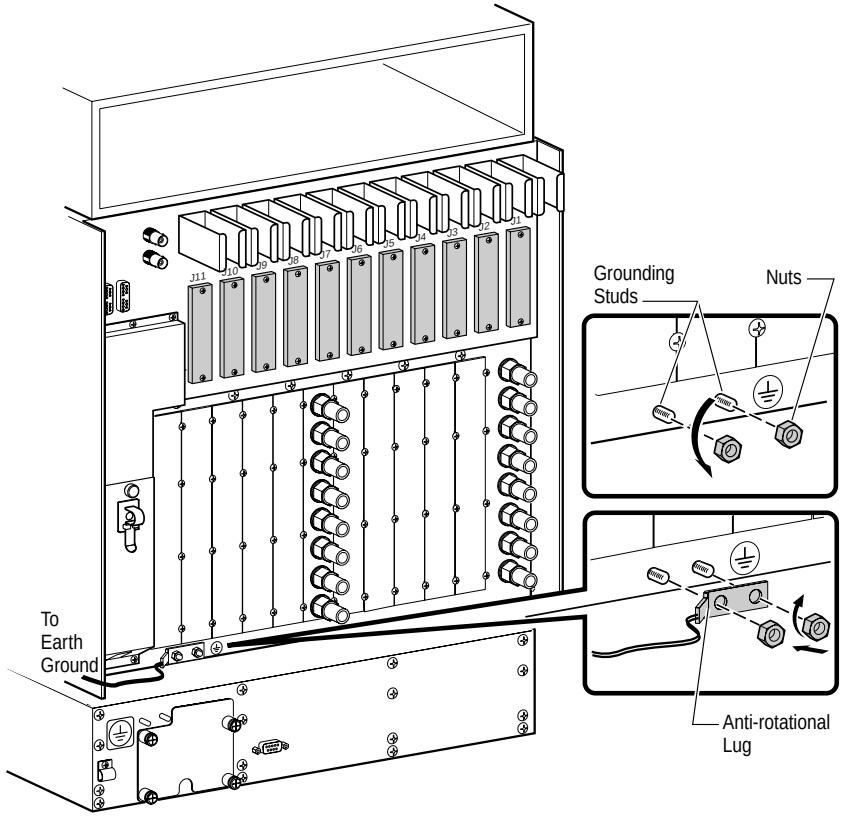


Figure 5-11 Earth Grounding the Chassis

3. Locate the power source switches on the front of the chassis and ensure that both are in the **off** position. Figure 5-12 shows the location of the power source switches on the front of the chassis.

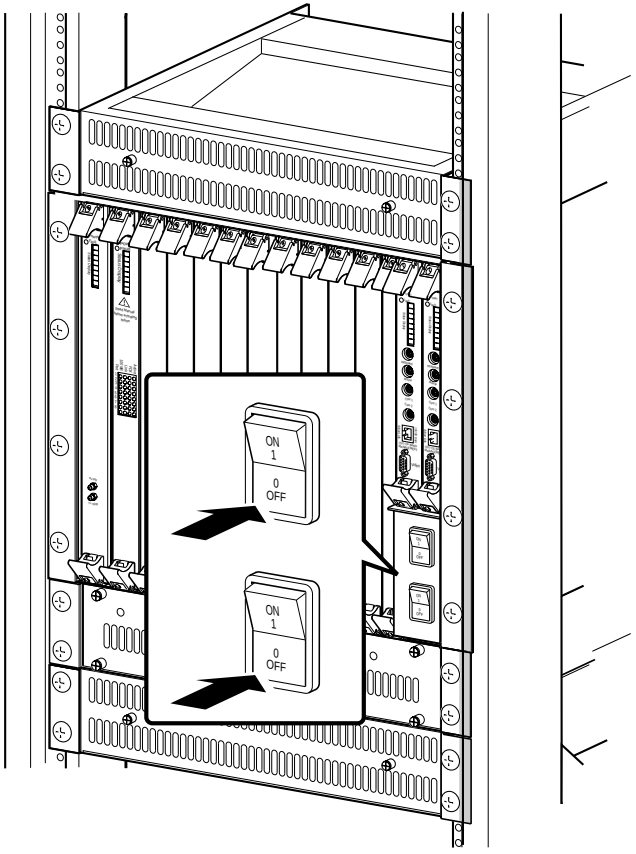


Figure 5-12 Power On/Off Switches

4. Remove the power connector cover on the rear of the chassis by loosening the screws that secure the cover, as shown in Figure 5-13. The power connector unit at the rear of the chassis consists of four #10 threaded power studs, also shown in Figure 5-13.

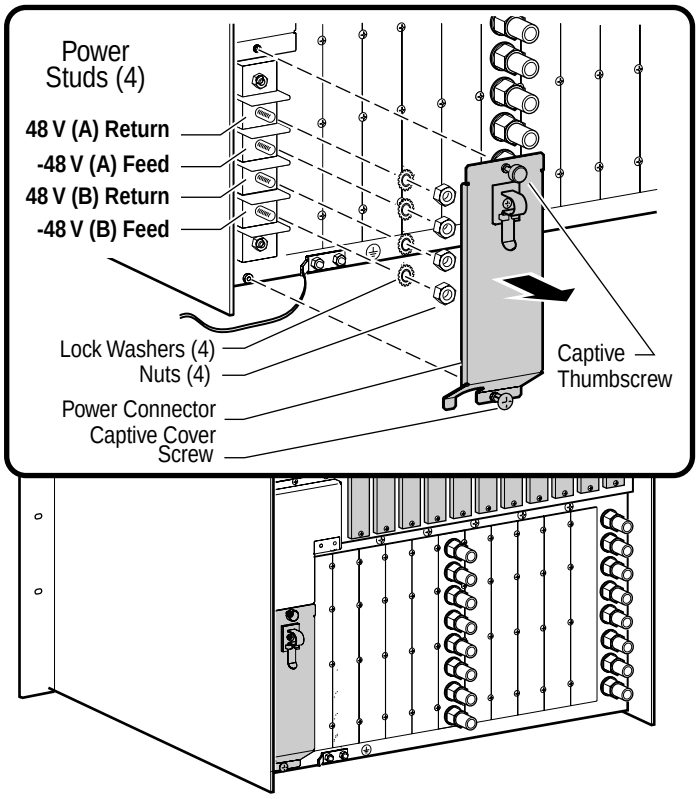


Figure 5-13 Power Connectors on Chassis

5. To connect the first (A) power source, do the following:

- Connect the return wire from the first power source to the power terminal labelled **48 V (A) Return**, as shown in Figure 5-14.

  and

- Connect the Source wire from the first power source to the power terminal labelled **–48 V (A) Feed**, as shown in Figure 5-14.

  and

- If you are connecting a second power source, go to the next step. If your are only connecting the single power source, go to step 7.

6. To connect the second (B) power source, do the following:

- Connect the return wire from the second power source to the power terminal labelled **48 V (B) Return**, as shown in Figure 5-14.

  and

- Connect the Source wire from the second power source to the power terminal labelled **–48 V (B) Feed**, as shown in Figure 5-14.

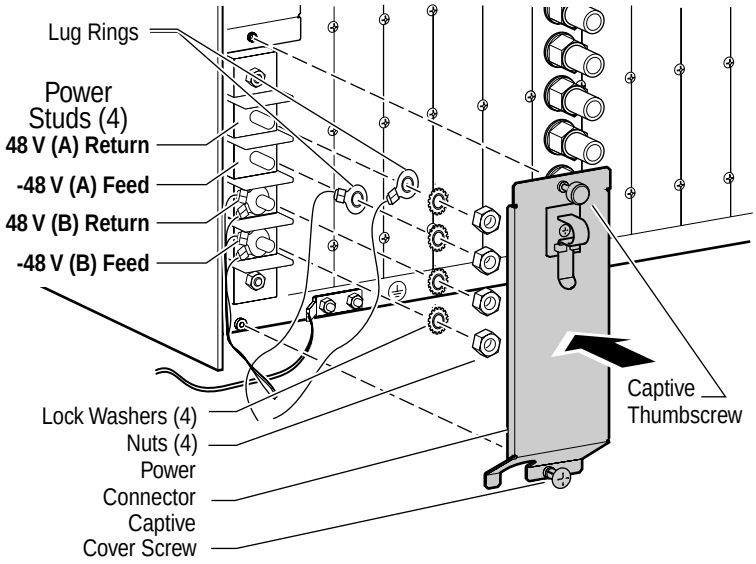


Figure 5-14 Wiring the Power

7. Cover the power connectors with the Power Connector Cover, ensuring that the wiring is properly placed through the opening at the bottom of the cover. Then place the wires through the resistance clasp on the cover, as shown in Figure 5-15.

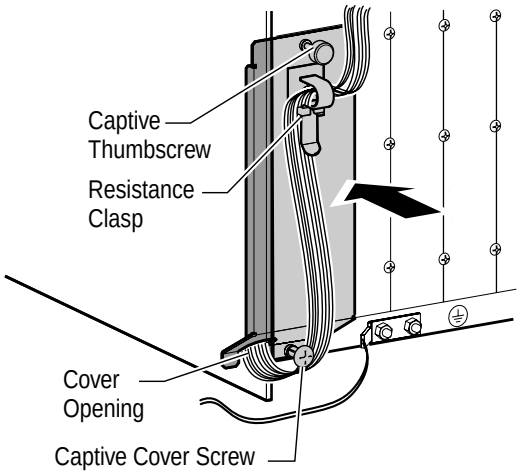


Figure 5-15 Covering the Power Connectors

You must now cable the power sources to the fan tray assembly, as described in "Connecting Power to the Fan Tray".

Connecting Power to the Fan Tray

The fan tray assembly supports connection to redundant power sources. Use No. 16 gauge electrical wire to connect the power sources to the fan tray. To cable the power sources to the fan tray assembly, use the following procedure:

WARNING: Before cabling system power, you must review, understand, and follow these guidelines and precautions:

- Before you connect the power sources to the system, be sure that the circuit to which you are connecting the system is off so that all power is removed from the circuit and the wires that you are connecting.
- Take care not to overload the power supply circuit to which you are connecting the system.
- Before proceeding with connecting the power lines to the system, remove all jewelry such as rings, watches, and necklaces.
- Do not work alone whenever potentially hazardous conditions exist.
- Before beginning the power cabling procedure, locate the emergency power-off switch for the location in which you are working

- Before proceeding with connecting the power lines to the system, check your work area for possible hazards such as ungrounded power extension cables and moist floors.

You need a No. 1 phillips screwdriver to connect power to the fan tray.

1. If you haven't already done so, review *"Electrical Safety Guidelines and Precautions"* on page 59.
2. Earth ground the fan tray assembly by connecting the ground wire to the two grounding terminals on the back of the fan tray using the anti-rotational lug, as shown in Figure 5-16.

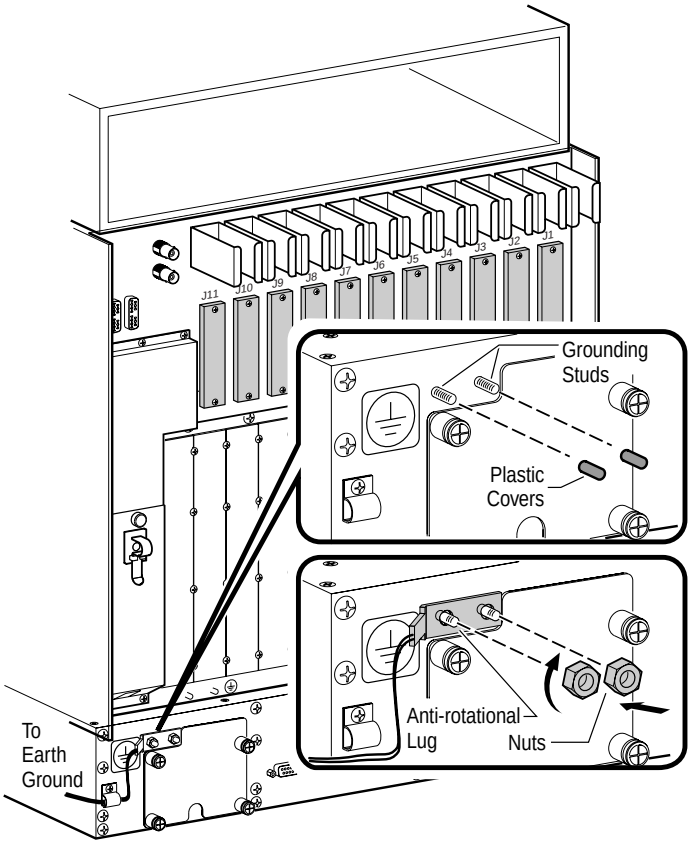


Figure 5-16 Earth Grounding the Fan Tray

3. Remove the power connector cover located on the rear panel of the fan tray unit by loosening the four screws that secure the cover, as shown in Figure 5-17. The power connector unit consists of four threaded power studs and two slow-blow class 2 fuse cartridges, also shown in Figure 5-17.

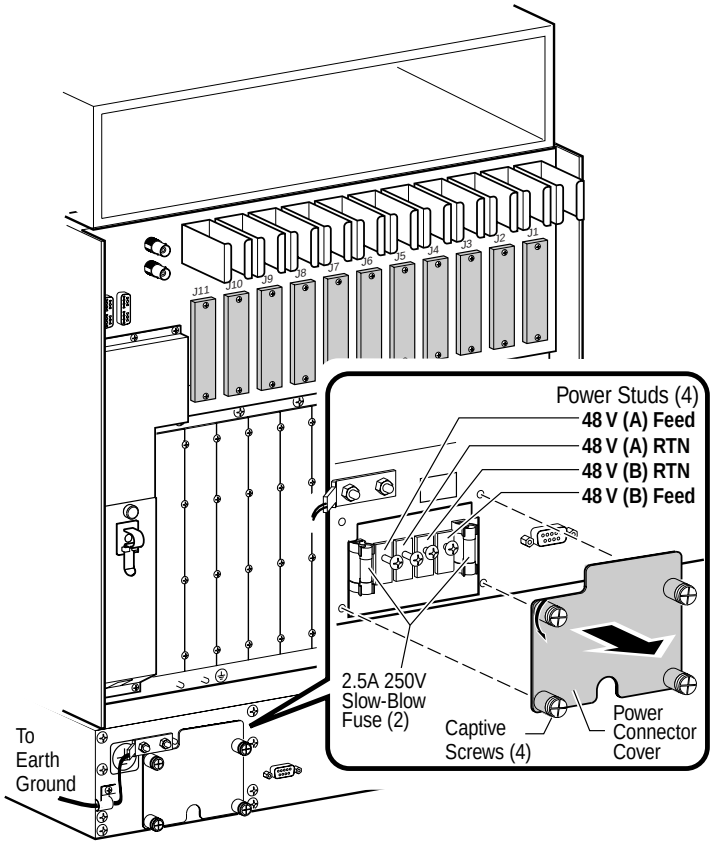


Figure 5-17 Fan Tray Power Connectors

4. To connect the first (A) power source, do the following:

- Connect the source wire from the first power source to the power terminal labelled **48 V (A) Feed**, as shown in Figure 5-18.

  and

- Connect the return wire from the first power source to the power terminal labelled **48 V (A) RTN**, as shown in Figure 5-18.
- If you are connecting a second power source, go to the next step. If your are only connecting the single power source, go to 6..

5. To connect the second (B) power source, do the following:

- Connect the return wire from the second power source to the power terminal labelled **48 V (B) RTN**, as shown in Figure 5-18.

  and

- Connect the source wire from the second power source to the power terminal labelled **48 V (B) Feed**, as shown in Figure 5-18.

6. Cover the power connectors with the power connector cover, ensuring that the wires are properly placed through the opening at the bottom of the cover. Then place the wires through the cable clamp, as shown in Figure 5-18.

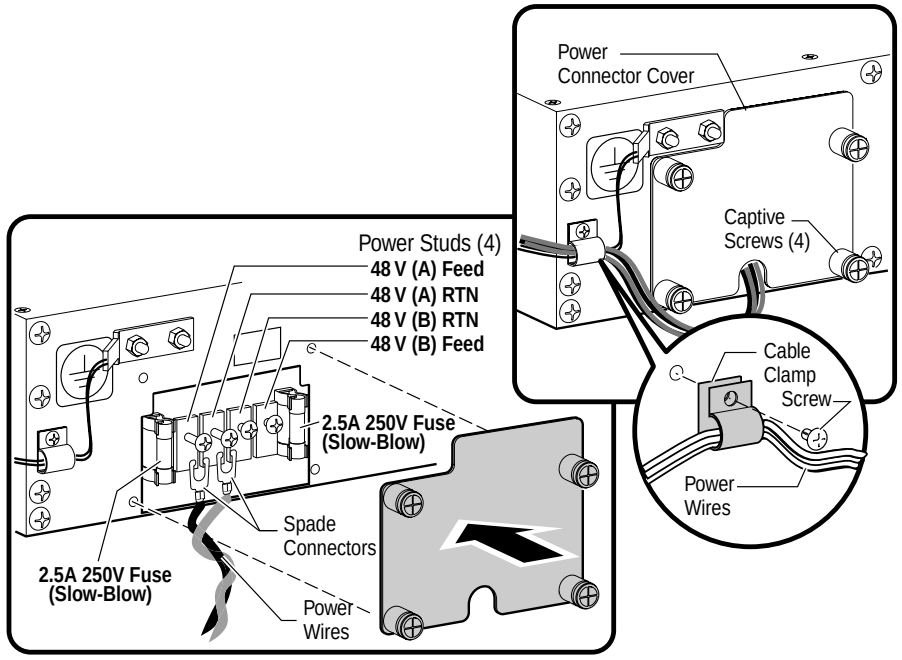


Figure 5-18 Wiring Fan Tray Power

Replacing Fan Tray Fuse Cartridges

The power connector unit consists of four threaded power studs and two slow-blow class 2 fuse cartridges. If one or both of the fuses blow, replacement of the fuse cartridge is necessary. To replace a blown fuse, follow this procedure:

1. If you haven't already done so, review *"Electrical Safety Guidelines and Precautions"* on page 59.
2. Remove the power connector cover located on the rear panel of the fan tray unit by loosening the four screws that secure the cover, as shown in Figure 5-17.
3. Locate the blown fuse and remove it.
4. Replace the fuse with a 2 1/2 Amp 250 Volt slow-blow fuse only.
5. Cover the power connectors with the power connector cover, ensuring that the wires are properly placed through the opening at the bottom of the cover. Then place the wires through the cable clamp, as shown in Figure 5-18.

Cabling for System Fault Reporting

A timing and alarms (TAC) daughter card on the Management module allows for the monitoring of fault conditions on an externally connected fan tray or power supply.

Two DB-15 connectors located on the rear of the chassis are used to cable fault reporting on the Cuda 12000. Figure 5-19 shows the location of these connectors:

Alarms In	This DB-15 receives fault signals from the connected devices. Facing the rear of the chassis, this is the serial connector on the right.
Alarms Out	Transmits fault signals to an external indication device. Facing the rear of the chassis, this is the serial connector on the left. To connect to an external alarm indication device, see the instructions for the device to which you are cabling.

You can configure which incoming faults the system reports on and which of those signals to send out to an external indication device. For more information, see the *Cuda 12000 IP Access Switch* documentation suite.

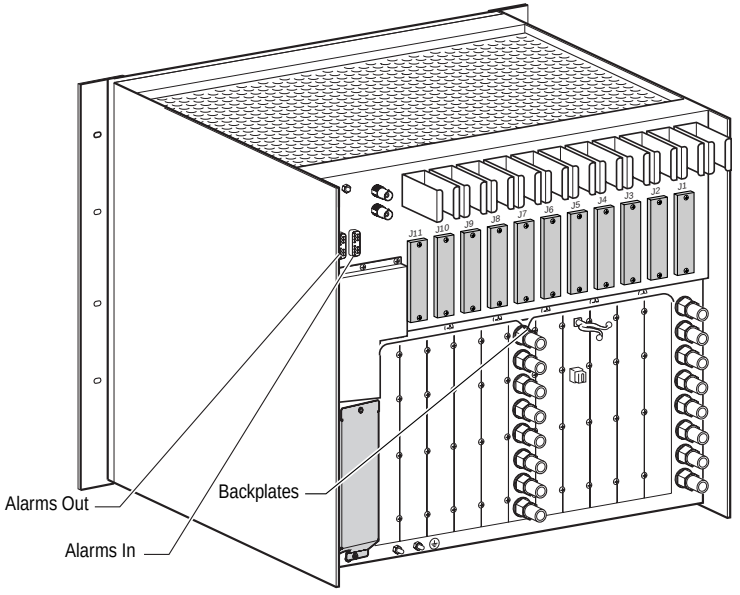


Figure 5-19 Serial Connectors Used for Fault Reporting

To receive fault signals, you must attach the devices that you want to report on to the *Alarms In* DB-15 connector using one of these ADC-provided cables:

2-way cable - This cable consists of these connectors:

- DB-15 for connection to the chassis.
- DB-9 for connection to the fan tray.

3-way cable - This cable consists of these connectors:

- DB-15 for connection to the chassis.
- DB-9 for connection to the fan tray.
- DB-25 for connection to a single power supply.

Different power supplies may utilize different connectors. Contact ADC Customer Support for details.

Use the following procedure to cable the system for fault reporting:

1. If you haven't already done so, review *"Electrical Safety Guidelines and Precautions"* on page 59.
2. Do one of the following:
   - If you are cabling to a fan tray only, use the *2-way cable* and attach the DB-9 connector on the cable to the DB-9 port on the rear panel of the fan tray. Then connect the DB-15 connector on the other end of the cable to the *Alarms In* port on the rear of the chassis. Refer to Figure 5-20.

     or

   - If you are cabling to a single power supply, or both a fan tray and power supply, use the *3-way cable* and attach the DB-9 connector on the cable to the DB-9 port on the rear panel of the fan tray and the DB-25 connector to the power supply. Then connect the DB-15 connector on the other end of the cable to the *Alarms In* port on the rear of the chassis. Refer to Figure 5-21.

Figure 5-20 shows the cabling of the fan tray to the Alarms In DB-15 connector on the rear chassis panel using the 2-way cable.

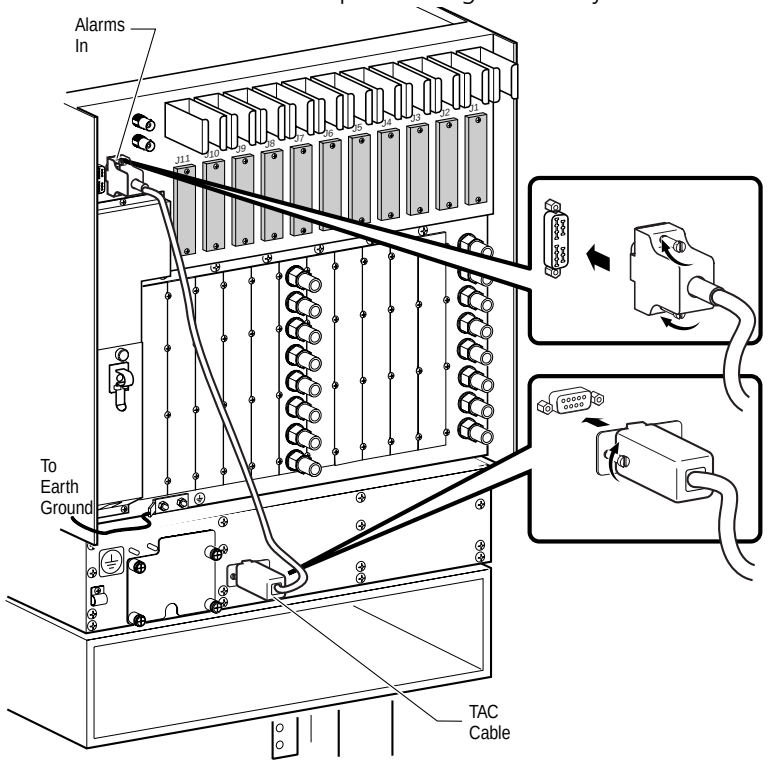


Figure 5-20 Cabling for Fault Reporting with 2-way Cable

Figure 5-21 shows the cabling of the Alarms In DB-15 connector on the rear chassis panel to the fan tray and the power source using the 3-way cable.

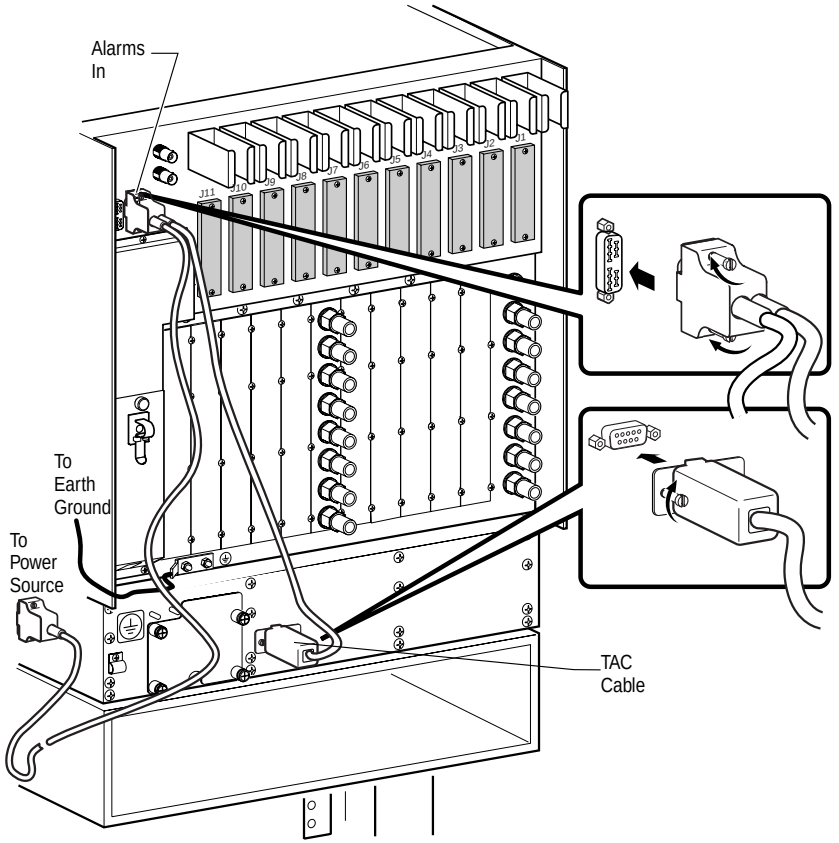


Figure 5-21 Cabling for Fault Reporting with 3-way Cable

Refer to Appendix C for fault reporting wiring diagrams.

6 POWERING ON AND POWERING OFF

This chapter describes how to power on the Cuda 12000 and includes:

- Powering On the System
- Observing LED Activity
- Understanding the Initialization Process
- Powering Off the System
- Basic Troubleshooting

Before proceeding with the procedures in this chapter, you should read Chapter 2, *"Preparing for Installation."*

If you are using the optional Martek Power Supply, refer to Appendix C, *"Martek Power Supply"* for an explanation of the front panel LEDs and some basic troubleshooting techniques.

Powering On the System

Use this procedure to power on the system:

1. Ensure that you have properly performed these tasks as described in this guide:
   - Rack-mounted the fan tray, chassis, and plenums as described in Chapter 3, *"Rack-Mounting the System."*
   - Installed all required system modules as described in Chapter 4, "*Installing Modules*."
   - Cabled the system as described in Chapter 5, "*Cabling the System*."
2. Power on the fan tray by activating the power source to which you have connected it. The fan tray begins operating immediately. Three LEDs (one for each fan tray unit within the assembly) illuminate green to indicate the cooling unit is operating correctly.

3. Ensure that the power source to which you have connected the chassis is *on*.
4. Move the top power source (A) switch, located in the lower-right front of the chassis, to the *on* position.
5. If you have connected to a second power source, move the lower power source (B) switch, located in the lower right-front of the chassis, to the *on* position.

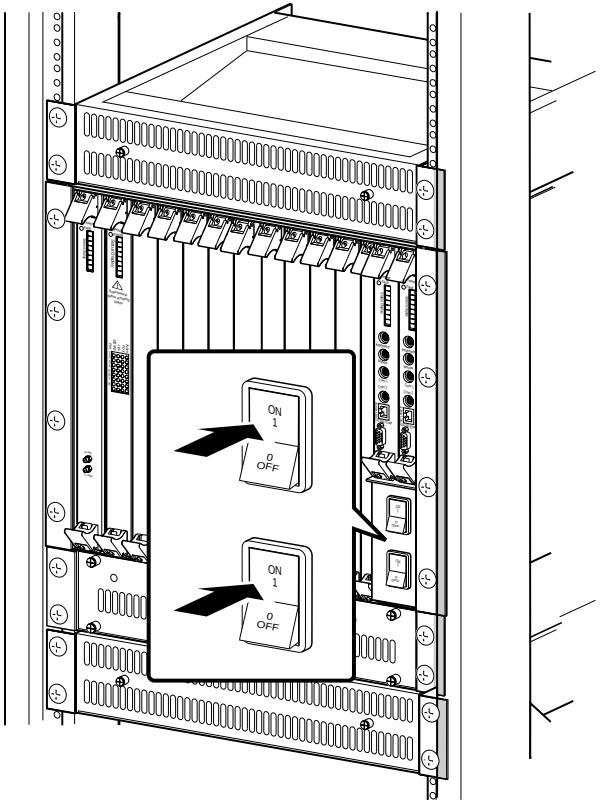


Figure 6-1 Power On/Off Switches

Observing LED Activity

Modules have power and fault LEDs to indicate operating status. When you power on the Cuda 12000, the LEDs on the modules illuminate as each module begins an initialization process that includes diagnostics and the loading of operational code, as described in *"Understanding the Initialization Process,"* next.

Understanding the Initialization Process

After powering on, the Cuda 12000 runs through a boot process that includes both hardware and software diagnostics and initialization. During this process, the on-board processors mounted on each application module write initialization status messages to the 8-character LED display that is located on the module faceplate. These status messages indicate the initialization stage currently in process.

Similarly, whenever you install an individual module while the system is operating, the newly installed module runs through the same initialization process and displays the same status messages.

Figure 6-1 describes the various status messages that you may see during this initialization process.

In addition to the messages listed in the tables below, any module with a Pentium processor will display a series of POST codes while booting. Contact ADC Customer Support for additional information regarding POST codes.

Table 6-1 Module Initialization Phases

Module Type	Message	Description
All Modules	`Booting`	Module is starting the initialization process and reading the boot image into memory.
All Modules	`Diags`	Module is performing diagnostics.
All Modules	`Diags OK`	Module has completed diagnostics of both the network processor and, in the case of a route server or DOCSIS/EuroDOCSIS module, the pentium processor.
All Modules	`Loading`	Module is loading operational code.
All Modules	`Starting`	Operational code is starting. Control passed to operational code and network processor.
All Modules	`Init`	Module is initializing.
All Modules	`Init OK`	Module has initialized successfully.

Table 6-1 Module Initialization Phases (continued)

Module Type	Message	Description
Octal 10/100 Ethernet SpectraFlow Module	`10/100`	■ When displayed immediately before `Init`, signals start of software control. Indicates module supports 10/100 Ethernet media. ■ When displayed after `Init`, this message indicates that the module is operational without error.
	`10/100.`	■ The 10/100 message followed by a period—"`.`"—indicates a software crash has occurred; the module resets itself. Contact ADC Customer Support.
	`10/100rs`	■ When appended with `rs`, indicates that ADC has configured the module as the system's route server. The module operates in both a forwarding and route server capacity.
Gigabit Ethernet SpectraFlow Module	`1000`	■ When displayed immediately before `Init`, signals start of software control. Indicates module supports Gigabit Ethernet media. ■ When displayed after `Init`, this message indicates that the module is operational without error.
	`1000.`	■ The 1000 message followed by a period—"`.`"—indicates a software crash has occurred; the module resets itself. Contact ADC Customer Support.
	`1000rs`	■ When appended with `rs`, indicates that ADC has configured the module as the system's route server. The module operates in both a forwarding and route server capacity.

Table 6-1 Module Initialization Phases (continued)

Module Type	Message	Description
Packet Over SONET (POS) OC-3 SpectraFlow Module	`OC3`	■ When displayed immediately before `Init`, signals start of software control. Indicates module supports OC-3 media. ■ When displayed after `Init`, this message indicates that the module is operational without error.
	`OC3.`	■ The OC3 message followed by a period—"`.`"—indicates a software crash has occurred; the module resets itself. Contact ADC Customer Support.
	`OC3rs`	■ When appended with `rs`, indicates that ADC has configured the module as the system's route server. The module operates in both a forwarding and route server capacity.
Packet Over SONET (POS) OC-12 SpectraFlow Module	`OC12`	■ When displayed immediately before `Init`, signals start of software control. Indicates module supports OC-12 media. ■ When displayed after `Init`, this message indicates that the module is operational without error.
	`OC12.`	■ The OC12 message followed by a period—"`.`"—indicates a software crash has occurred; the module resets itself. Contact ADC Customer Support.
	`OC12rs`	■ When appended with `rs`, indicates that ADC has configured the module as the system's route server. The module operates in both a forwarding and route server capacity.
DOCSIS/EuroDOCSIS Modules	`CMTS`	Displayed immediately before Init, signals start of software control. Indicates module is a DOCSIS or EuroDOCSIS module.

Table 6-1 Module Initialization Phases (continued)

Module Type	Message	Description
DOCSIS/ EuroDOCSIS Modules	DS<frequency>	Indicates that the module has initialized its downstream port. Displays the current downstream frequency. Where DS stands for "downstream" and *<frequency>* is a variable that indicates the current frequency of the downstream channel. For example, a downstream frequency of 507.00 results in this DOCSIS module operational status display: DS507.00.
Management Module	Starting	Indicates that the module software is initializing memory.
Management Module	SC Start	Indicates that controller components are starting up.
Management Module	Ready	Indicates that the Management module components have started and the module is operational without error.

Figure 6-2 provides a listing of messages that may indicate error conditions during the module boot phase.

Table 6-2 Boot Error Messages

Module Type	Operational Status Indication	Description
All Modules	HW Fail!	A module hardware component has failed a diagnostic check. Contact ADC Customer Support for assistance.
DOCSIS/ EuroDOCSIS Modules	cmts up	Indicates a crash. Sometimes resetting the DOCSIS/EuroDOCSIS module will solve the problem, but additional troubleshooting may be necessary.
Management Module	SC Fail	Indicates that at least one Management module component could not start. Reboot the module. If the problem persists, contact ADC Customer Support.

Table 6-2 Boot Error Messages (continued)

Module Type	Operational Status Indication	Description
Management Module	`SC Down`	Displayed after issuing the *ccdown* command from the CLI. Indicates all Management module components have safely shut down.
Management Module	`SC Reset`	Displayed after issuing a *reset* command for the Management module from the CLI. Indicates that the Management module will safely shut down and then reset.

Powering Off the System

Use this procedure to properly power off the system:

1. Log on to the Linux operating system with the following login information:

   Account Name: root
   Password: bas

2. Run halt.
3. After a few minutes, the LED display(s) on the module(s) will display `Stopped`.
4. Move the top power source (A) switch, located in the lower-right front of the chassis, to the *off* position.
5. If you have connected to a second power source, move the lower power source (B) switch, located in the lower right-front of the chassis, to the *off* position.

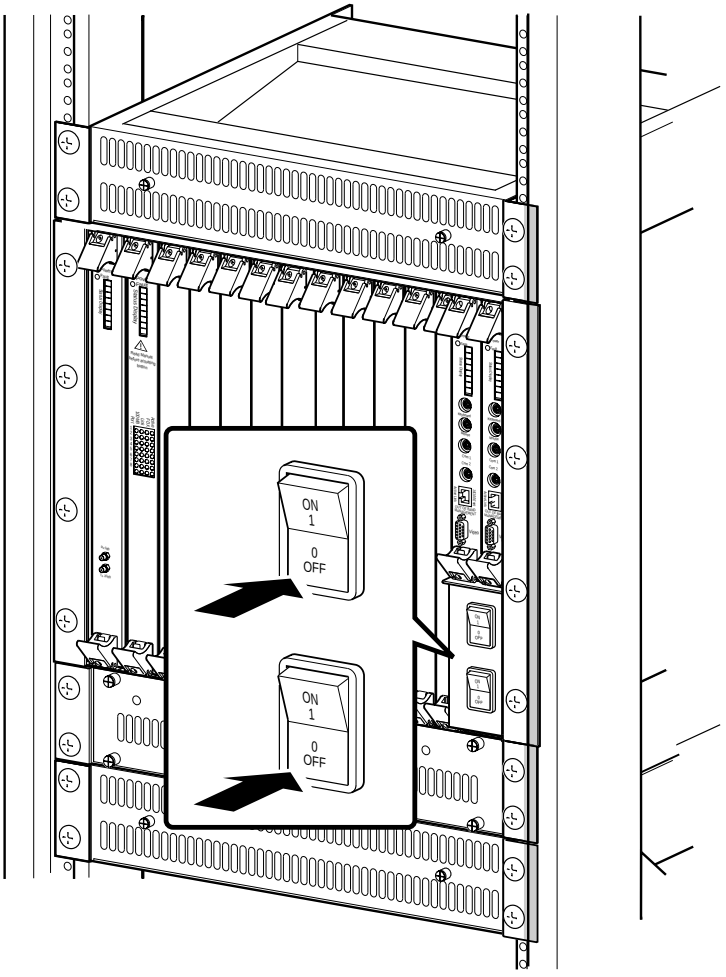


Figure 6-2 Power On/Off Switches

Basic Troubleshooting

This section suggests possible actions to take when the green power LED on a module does not illuminate.

- Make sure the card is firmly seated in place and secured in the chassis.
- If the card appears to be seated correctly in place, remove and then replace the card.
- If the green light still does not illuminate, reset the module by pressing the recessed reset button located directly beneath the 8-character LED status display on the module faceplate. Note that to reboot a DOCSIS or EuroDOCSIS module, you must hold down the reset button for 5 seconds.
- If the power LED fails to illuminate, contact an ADC representative to report the faulty module behavior and obtain further instructions.

A CONFIGURING NETWORK ACCESS

This chapter explains the steps required to get started using your Cuda 12000 IP Access Switch. The 10/100 CRAFT management interface must be configured with a valid IP address appropriate to your network environment. This chapter also addresses security considerations, such as: default system accounts and unauthorized access to your network.

Network Access

This section describes how to log on to the Linux environment, and how to configure the Cuda 12000 CRAFT management interface to provide IP network access. Configuration procedures specific to network management are detailed in the *Cuda 12000 IP Access Switch CudaView Administration Guide* and the *Cuda 12000 IP Access Switch CLI-based Administration Guide.*

Logging On

Use the following procedure to log on to the Linux environment as the root operating system user:

1. Ensure that you have cabled a system running a terminal emulation program to COM port 1.
2. Access the system through the terminal emulator. Press **Enter** until you see the Linux logon prompt.
3. You will be prompted for a logon name and password to log on to the Linux operating system. Enter your logon name and password using lowercase characters. The system ships with the following system defaults:
   - **Account Name:** administrator
   - **Password:** bas

4. From the command prompt, type **su**.
5. Type the root user password. The system default is **bas**.

You are now logged into the Linux operating system as the root user.

Configuring Network Access

To configure network access on the Cuda 12000, follow this procedure:

1. Log on as the Linux operating system root user as described above.
2. Run `config_cuda.sh`
3. Enter the following parameters:

   Note: Pressing the enter key, without typing in a parameter, will enter the default value displayed within the brackets.

Prompt	Parameter
Do you wish to configure a redundant Chassis Controller? [Y]	Type **n**. For more information on configuring redundant chassis controller, refer to the *Cuda 12000 IP Access Switch CudaView Administration Guide* or the *Cuda 12000 IP Access Switch CLI-based Administration Guide*.
Hostname of this Chassis Controller:	Type in a name for this host chassis controller.
IP address for eth0 [192.168.212.110]:	Enter the IP address.
Netmask [255.255.255.0]:	Enter the subnet mask.
Gateway address [192.168.212.1]:	Enter the gateway address.
Would you like to configure eth1 with the default value? [Y]:	To accept the default configuration for eth1 shown, press **enter**, else type **n** and press **enter**.
Network address [192.0.2.0]:	If you did not accept the default configuration for eth1, this prompt will display. Type in a network address. *Note: 192.0.2.0/24 is the TEST-NET, which is the subnet used on the management network.*
Reboot now? [Y]	Reboot the Management module.

Security Considerations

This section lists the default system accounts that are shipped with the Cuda 12000. It also discusses IPChains, which are used to filter incoming packets to prevent unauthorized access to your network.

Default System Accounts

Your chassis is shipped with default system accounts. It is recommended that you change these accounts, specific to the needs of your network environment. The Cuda 12000 ships with the following default account information:

Logging into the CRAFT management port	When you SSH to the CRAFT management port, you log on to the Linux environment. The system ships with the following user account information: Account Name — administrator Account Password — bas
Accessing *root* privileges	To gain root privileges, log on to the Cuda 12000 as administrator *(see above)*, then su to root. The system ships with the default root password of bas.
Accessing Cuda 12000 Administration	The Cuda 12000 ships with the default administrative account information that you can use to log on to CudaView NMS or to access the CLI command shell, which is **bascli**.: Account Name — root Account Password — bas

IPChains

The Cuda 12000 is protected against unauthorized access to your network. and uses IPChains to filter incoming packets at the individual protocol, port and interface levels. IPChains is a tool available within the Linux operating system. IPChains no longer allows FTP connections inbound to the CRAFT port. Outbound FTP connections, via the CRAFT port, are still permitted.

Release 3.0 implements IPChains by the operating system software installation function, which is done at the ADC plant before your chassis is shipped. IPChains configuration may be modified within the Linux environment; go to the following file:

```
/etc/rc.d/init.d/bas_ipchains_setup
```

If your site requires FTP to be allowed on the CRAFT port, then edit the **/bas/bin/basipchains_setup** file and **uncomment** the FTP-related lines in the file. After you edit the file you must reboot the Management module for the changes to take affect.

B SYSTEM SPECIFICATIONS AND COMPLIANCE

Table A-1 System Specifications and Compliance

Physical Dimensions	■ 15.75" H x 17.1" W x 15.9" D ■ Weight: Approx 100 lbs (fully populated chassis) 28 lbs (chassis only)
Physical Interface Modules	■ 1x4 DOCSIS Module— 1 downstream channel, 4 upstream channels ■ 1x4 DOCSIS SpectraFlow Module— 1 downstream channel, 4 upstream channels ■ 1x6 DOCSIS SpectraFlow Module with Spectrum Management — 2 downstream channels, 6 upstream channels ■ 1x4 EuroDOCSIS Module — 1 downstream channel, 4 upstream channels ■ 1x4 EuroDOCSIS SpectraFlow Module — 1 downstream channel, 4 upstream channels ■ 1x4 EuroDOCSIS SpectraFlow Module with Spectrum Management — 2 downstream channels, 4 upstream channels ■ Octal 10/100BASE-TX Ethernet SpectraFlow Module ■ Gigabit Ethernet SpectraFlow Module ■ Packet Over SONET (POS) SpectraFlow Modules - POS OC-3 - POS OC-12
Downstream CMTS RF Interface	■ DOCSIS 1.0/1.1 ■ Frequency range: 93 MHz to 855 MHz settable in 250 kHz increments (STD, IRC, HRC) ■ Modulation: 64 or 256 QAM ■ Information rate: 27 or 38 Mbps

Upstream CMTS RF Interfaces	■ DOCSIS 1.0/1.1 ■ Frequency range: 5–42 MHz ■ Modulation: QPSK or 16 QAM ■ Information rate: 320 Kbps – 10 Mbps
Power Requirements	■ Voltage DC: –48V (–42 to –68) ■ Max Watts = 1100 ■ Amperage = 23 @ -48V
Environmental	■ Temperature: 0 – 40° C
Safety	■ UL 1950 Third Edition ■ CSA C22.2 No. 950 ■ EN 60950
Electromagnetic (EMC)	■ FCC Part 15, Class A ■ EN 55022 Class A
Protocols and Routing	■ Ethernet ■ RIPv1 ■ RIPv2 ■ OSPFv2 ■ Policy-based Route Filters
Provisioning/Directory Services	■ DHCP, TFTP, DNS/DDNS, SysLog, and Time servers ■ LDAP client & LDAP server ■ Dynamic creation of CM configuration files
Security	■ DOCSIS Baseline Privacy (BPI), BPI+ ■ CM and username/password authentication ■ Secure remote administration
Network Management	■ Craft Interface: 10/100BASE-TX ■ Web/Java-based graphical user interface (GUI), SNMP ■ MIBs: SNMP, ADC Cuda ■ CLI: Craft port and telnet
Software Load Capabilities	■ Multiple software versions stored within system ■ Software updates via FTP

C MARTEK POWER SUPPLY

ADC offers an optional power supply that can be used to power the Cuda 12000. The power supply system offered by ADC is the Martek power supply model PS2266 and bay model B2266.

Additional information and specifications can be obtained from the Martek Web site at: `http://www.martekpower.com`.

WARNING: *High voltage power supplies are extremely dangerous and should only be handled by a qualified electrical technician. Injury or death may result from improper handling.*

To protect you from potentially deadly electrical shock hazards as well as the equipment from accidental damage, do not attempt to repair, or modify the power supply and/or the bay.

Altering or modifying the power supply and/or bay without the written consent of Martek Power Inc. may invalidate the limited warranty.

This appendix explains the functionality of the front panel LEDs for the Martek power supply and some basic troubleshooting techniques .

Front Panel LEDs

This section describes the front panel LED indicators and the wiring logic. The following table provides a description of each LED:

LED	Description
Green LED	A status indicator of the output voltage. If the output voltage is above 40Vdc (+/- 5%) the green LED should be on. If the output voltage is less than 40Vdc (+/-5%) the green LED should be off.

LED	Description
Yellow LED	Designed so that it will always be the opposite of the green LED. If the output voltage is above 40Vdc (+/- 5%) the yellow LED should be off. If the output voltage is less than 40Vdc (+/-5%) the yellow LED should be on.

The LEDs are wired to the same logic as the DC_OK signal. Therefore, if the DC_OK signal (normally high) is high the Green LED will be on and the yellow LED will be off. If the DC_OK signal is low the Green LED will be off and the Yellow LED will be on.

The fault logic and LEDs are powered by the house keeping voltage; therefore, if the remote switch is off, the status of the DC_OK signal and the LEDs should be valid. They also have a backup bias voltage that comes from the outputs of the other power supplies (assuming more than one model PS2266 per bay). This backup voltage comes into play when one of the power supplies does not have an AC input (or a blown fuse). In this case, the backup voltage will power the fault logic, the yellow LED of the bad power supply should be on, and the green LED should be off (also DC_OK would be low).

Basic Troubleshooting

If there is no DC voltage, follow this procedure:

1. Verify that the output of the power supply (PS2266) chassis is connected properly to the Cuda chassis. The (–54Vdc) output of the PS2266 should be connected to the –48Vdc terminal marked "feed" on the Cuda chassis. Also make sure that the "RTN" on the PS2266, is connected to the terminal marked (+48V return) on the Cuda chassis.
2. Reset the PS2266 by turning the **ON/OFF** switch, on the back top right, marked "DC OUTPUT", off. Wait ten seconds and then turn it back on.

If steps 1 and 2 above fail, follow this procedure:

1. With the AC cords unplugged, take all four PS2266 modules out of their chassis and inspect them for damaged connectors. Also inspect the inside of the chassis for damaged or shorted connector pins.
2. With the PS2266 modules removed check the power supply chassis with an OHMmeter for a short to ground at the –54Vdc output terminal.

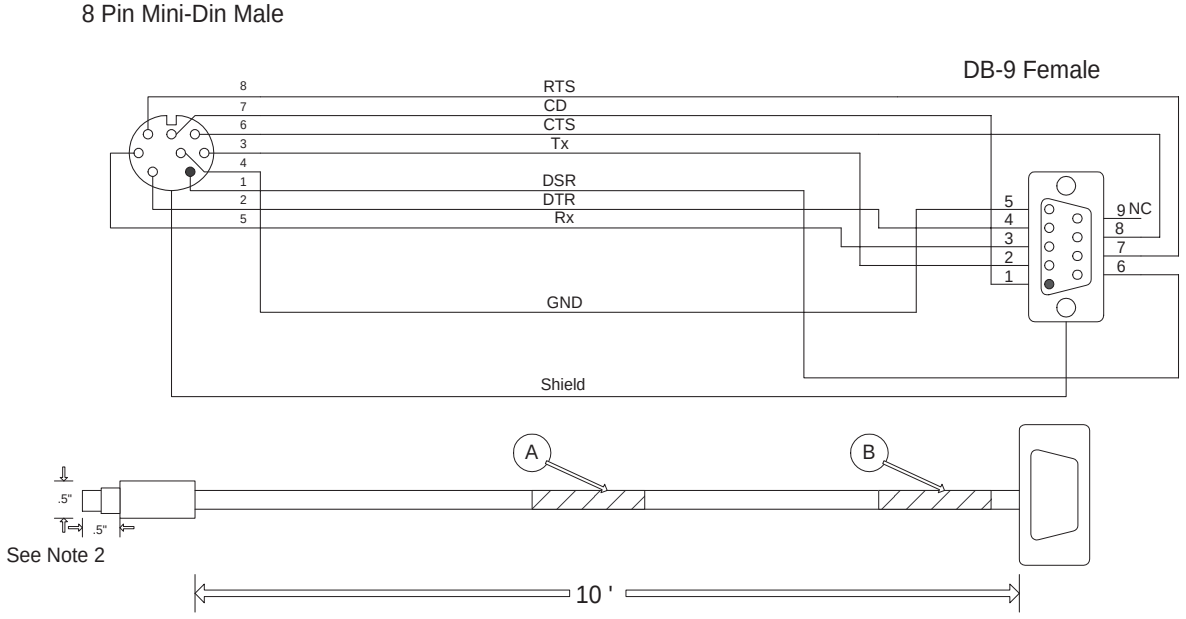
3. A PS2266 module may be shorted internally, and therefore would cause the entire power supply chassis to short. Try installing one module at a time and check for voltage output after each one is installed.

Note: Each of the four PS2266 modules delivers 1000 watts max (53Vdc @ 19 amps). The power supply chassis with all four power supply modules in and powered on provides 4000 watts. Refer to the "Connecting Power" section on page 109 to determine how much power is required for your configuration.

D WIRING DIAGRAMS

Cabling for Serial Access

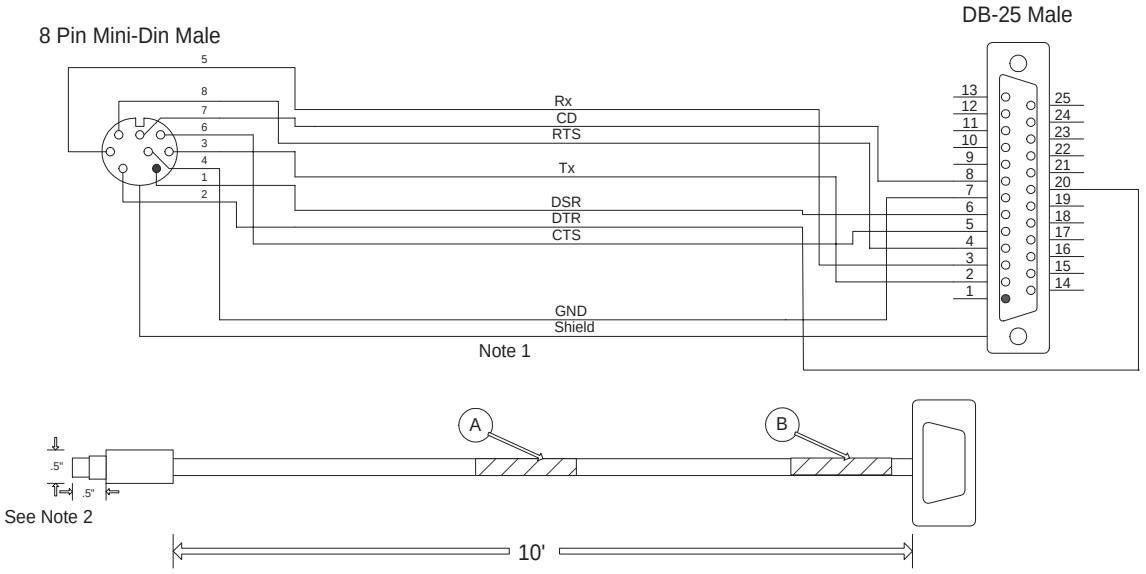
COM Terminal Cable Assembly



Notes:

1) Shield connection required, cable can use foil shield and drain wire
2) Any housing larger than .5" on the DIN8 connector must be .5" back away from the end of the DIN connector. The mating module connector is recessed within a .5" faceplate hole.

COM Modem Cable Assembly

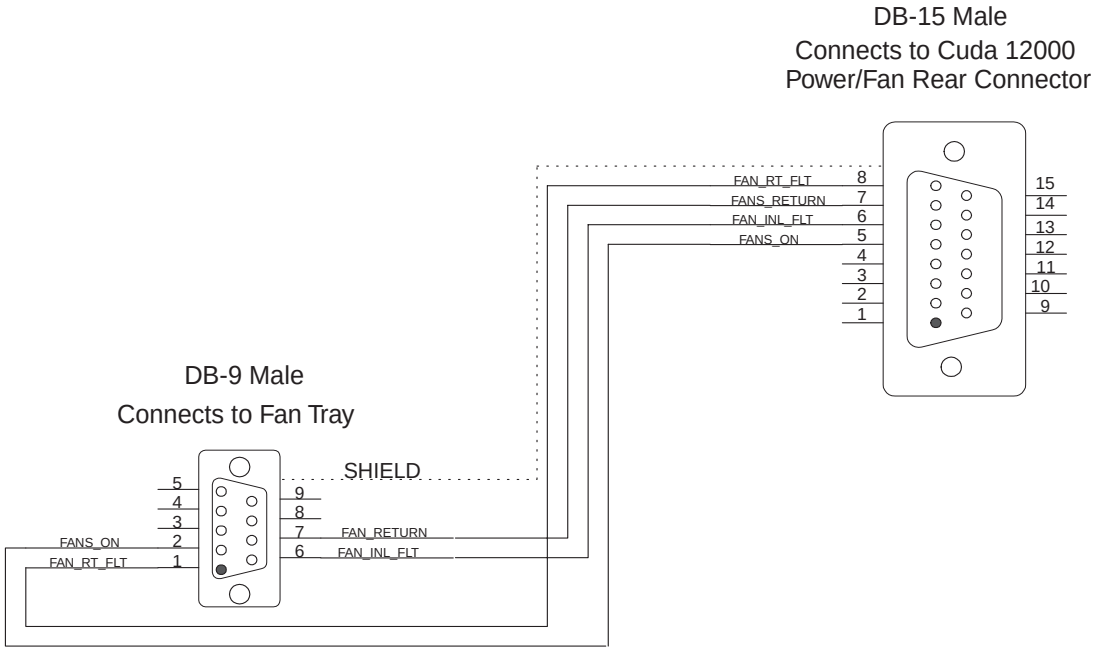


Notes:

1) Shield connection required, cable can use foil shield and drain wire.
2) Any over molding larger than .5" on the DIN8 connector must be .5" back away from the end of the DIN connector. The mating module connector is recessed within a .5" faceplate hole.

Cabling for Fault Reporting

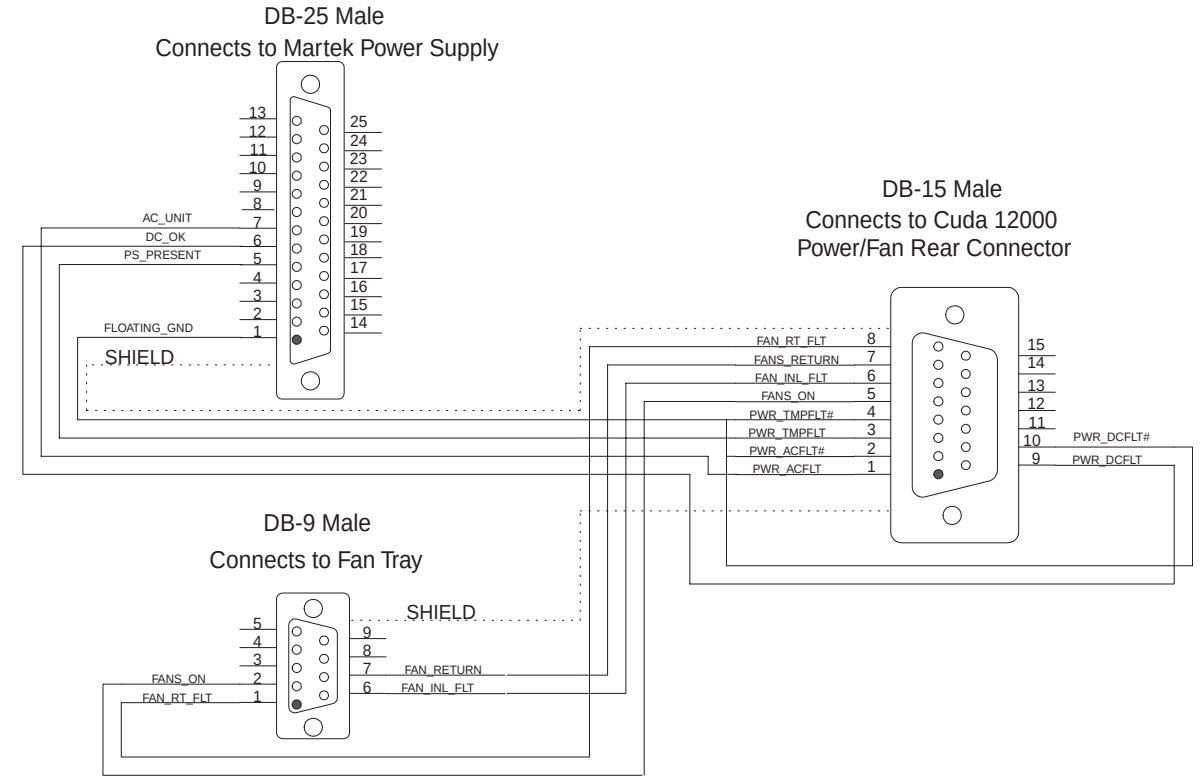
2-Way Cable for Cuda 12000 and Fan Tray



NOTES:

1. ALL UNUSED PINS ARE RESERVED. MAKE NO CONNECTIONS TO THEM.
2. CABLE WIRES ARE #24 GUAGE, SHIELDED.
3. CABLE SHIELDS ARE CONNECTED TO THE DB CONNECTOR SHELLS USING THE DRAIN WIRE.
4. CABLE LENGTH FOR THE DB9 TO DB15 SECTION IS 3 FEET.
5. APPLY A LABEL WITH THE ADC PART NUMBER 580-000016-00 REV 001 TO THE 3 FOOT SECTION. LABEL SHOULD BE ONE FOOT FROM THE DB 15 END OF THIS SECTION.
6. DB9 AND DB15 CONNECTORS MUST HAVE METALLIC EMI COVERS.

3-Way Cable for Cuda 12000, Fan Tray and Martek 4KW Power Supply



NOTES:

1. ALL UNUSED PINS ARE RESERVED. MAKE NO CONNECTIONS TO THEM.
2. CABLE WIRES ARE #24 GUAGE, SHIELDED.
3. CABLE SHIELDS ARE CONNECTED TO THE DB CONNECTOR SHELLS USING THE DRAIN WIRE.
4. CABLE LENGTH FOR THE DB9 TO DB15 SECTION IS 3 FEET.
5. CABLE LENGTH FOR THE DB25 TO DB15 SECTION IS 10 FEET.
6. APPLY A LABEL WITH THE ADC PART NUMBER TO THE 3 FOOT SECTION. LABEL SHOULD BE ONE FOOT FROM THE DB 15 END OF THIS SECTION.

E GLOSSARY

16 QAM

Modulation mode used by the CMTS. QAM uses both amplitude and phase modulation to encode multiple bits of data in one signaling element, thus achieving higher data transfer rates than just amplitude or phase modulation alone.

16 QAM encodes four bits per symbol as one of sixteen possible amplitude and phase combinations. 16 QAM refers to the number of discrete phase/amplitude states that are used to represent data bits.

64 QAM

A modulation mode used by the CMTS. 64 QAM uses both amplitude and phase modulation to encode multiple bits of data in one signaling element. 64 QAM encodes 6 bits per symbol as one of 64 possible amplitude and phase combinations.

256 QAM

A modulation mode used by the CMTS. 256 QAM uses both amplitude and phase modulation to encode multiple bits of data in one signaling element. 64 QAM encodes 8 bits per symbol as one of 256 possible amplitude and phase combinations.

A

Record that contains the IP address of the record's owner. Since hosts may have multiple IP addresses, multiple A records may match a given domain name.

Address Resolution Protocol (ARP)

A protocol for mapping an Internet Protocol address (IP address) to a physical machine address that is recognized in the local network. For example, in IP Version 4, the most common level of IP in use today, an address is 32 bits long. In an Ethernet local area network, however, addresses for attached devices are 48 bits long. (The physical machine address is also known as a Media Access Control or MAC address address.)

American National Standards Institute (ANSI)	The primary organization for fostering the development of technology standards in the United States.
ARP	See Address Resolution Protocol.
Bandwidth Allocation Map	The downstream MAC Management Message that the CMTS uses to allocate transmission opportunities to CMs.
Baseline Privacy Interface	Provides data privacy for DOCSIS 1.0 CMs and CMTS. BPI+, provides privacy for DOCSIS 1.1 CMs and CMTS.
BDU	See Bridge Protocol Data Unit.
Bootstrap Protocol (BOOTP)	A protocol that lets a network user be automatically configured (receive an IP address) and have an operating system boot or initiated without user involvement. The BOOTP server, managed by a network administrator, automatically assigns the IP address from a pool of addresses for a certain duration of time.
BPI	See Baseline Privacy Interface.
Bridge Protocol Data Unit (BDU)	Spanning tree protocol messages as defined in [ISO/IEC10038].
Broadband	Network technology that multiplexes multiple, independent network carriers onto a single cable or fiber. The technology is used to carry voice, video, and data over the same cable or fiber.
Broadcast	Transmission to two or more devices at the same time, such as over a bus-type local network or by satellite; protocol mechanism that supports group and universal addressing.
Broadcast Addresses	A predefined destination address that denotes the set of all data network service access points.
Cable Modem (CM)	A modulator-demodulator at subscriber locations intended for use in conveying data communications on a cable television system.
Cable Modem Termination System (CMTS)	A device located at the cable system head-end or distribution hub, that interfaces the HFC network to local or remote IP networks.

Cable Modem Termination System - Network Side Interface (CMTS-NSI)	The interface, defined in [DOCSIS3], between a CMTS and the equipment on its network side.
Cable Modem to CPE Interface (CMCI)	The interface, defined in [DOCSIS4], between a CM and CPE.
Carrier Hum Modulation	The peak-to-peak magnitude of the amplitude distortion relative to the RF carrier signal level due to the fundamental and low-order harmonics of the power-supply frequency.
Carrier-to-Noise Ratio (C/N or CNR)	The voltage difference between the digitally-modulated RF carrier and the continuous random noise. CNR is measured in decibels (dB).
CM	See Cable Modem.
CMCI	See Cable Modem to CPE Interface.
CMTS	See Cable Modem Termination System.
C/N or CNR	See Carrier-to-Noise Ratio.
CNAME	A record that contains an alias or nickname for the official domain name (also known as the canonical name).
Cross-Modulation	A form of television signal distortion where modulation from one or more television channels is imposed on another channel or channels.
Customer Premises Equipment (CPE)	Equipment at the end user's premises. This equipment may be provided by the end user or the service provider.
Data Link Layer	Layer 2 in the Open System Interconnection (OSI) architecture; the layer that provides services to transfer data over the transmission link between open systems.
DHCP	See Dynamic Host Configuration Protocol.
Distribution Hub	A location in a cable television network which performs the functions of a head-end for customers in its immediate area, and which receives some or all

	of its television program material from a Master Head-end in the same metropolitan or regional area.
DNS	See Domain Name System.
DOCSIS	Data Over Cable Service Interface Specification, developed by CableLabs. Defines interface standards for cable modems transmission and supporting equipment.
Domain Name System (DNS)	An on-line, distributed database used to map human-readable machine names into IP address for resolving machine names to IP addresses.
Downstream	The direction of data flow from the head-end (CMTS) to the subscriber (CM).
Drop Cable	Coaxial cable that connects to a residence or service location from a directional coupler (tap) on the nearest coaxial feeder cable.
Dynamic Host Configuration Protocol (DHCP)	A protocol that allows dynamic assignment of IP addresses to CPEs. DHCP is also used to assign IP addresses to CMs.
Dynamic Range	The ratio between the greatest signal power that can be transmitted over a multichannel analog transmission system without exceeding distortion or other performance limits, and the least signal power that can be utilized without exceeding noise, error rate or other performance limits.
Ethernet	A networking standard running speeds of 1 Gbps (Gigabit Ethernet), 10 Mbps (10BaseT) or 100 Mbps (100BaseT). Ethernet typically uses twisted pair wiring or optical fiber.
EuroDOCSIS	European Data Over Cable Service Interface Specification, developed by tComLabs and CableLabs. Defines interface standards for cable modems transmission and supporting equipment.
Extended Subsplit	A frequency division scheme that allows bidirectional traffic on a single coaxial cable. In the U.S., reverse path signals come to the head-end from 5 to 42 MHz. Forward path signals go from the head-end from 50 or 54 MHz to the upper frequency limit.
FDDI	See Fiber Distributed Data Interface.
FEC	See Forward Error Correction.

Feeder Cable	Coaxial cables that run along streets within the served area and connect between the individual taps which serve the customer drops.
Fiber Node	The interface between a fiber trunk and the coaxial distribution. Fiber nodes are located in a subscribers neighborhood.
File Transfer Protocol (FTP)	A protocol that allows users to log into a remote system, identify themselves, list remote directories, and copy files to and from the remote machine. FTP understands a few basic file formats. It is more complex than Telnet in that it maintains separate TCP connections for control and data transfer.
Flow	A unidirectional data path between a cable modem and a CMTS.
Forward Error Correction (FEC)	A technique for correcting errors incurred in transmission over a communications channel by the receiver, without requiring the retransmission of any information by the transmitter; typically it involves a convolution of the transmitted bits and the appending of extra bits, using a common algorithm by both the receiver and transmitter.
FTP	See File Transfer Protocol.
Gateway	A device that communicates with two protocols and translates services between them.
Graphical User Interface (GUI)	A program that displays information using graphics instead of command line text. The user can interact with a computer operating system through a series of “windows”, also known as “point and click”
Group Delay	The difference in transmission time between the highest and lowest of several frequencies through a device, circuit or system.
Guard Time	Minimum time allocated between bursts in the upstream referenced from the symbol center of the last symbol of a burst to the symbol center of the first symbol of the following burst. The guard time should be at least the duration of five symbols plus the maximum system timing error.
GUI	See Graphical User Interface.
Harmonic Related Carrier (HRC)	A method of spacing television channels on a cable television system in exact 6-MHz increments, with all carrier frequencies harmonically related to a common reference.

Head-End The central location on the cable network that originates the broadcast video and other signals in the downstream direction. See also Master Head-end, Distribution Hub.

Header Protocol control information located at the beginning of a protocol data unit.

HF See High Frequency.

HFC See Hybrid Fiber/Coaxial.

High Frequency (HF) The entire subsplit (5-30 MHz) and extended subsplit (5-42 MHz) band used in reverse channel communications over the cable television network.

High Return A frequency division scheme that allows bi-directional traffic on a single coaxial cable. Reverse channel signals propagate to the head-end above the downstream passband.

HRC See Harmonic Related Carrier.

Hum Modulation Undesired modulation of the television visual carrier by the fundamental or low-order harmonics of the power supply frequency, or other low-frequency disturbances.

Hybrid Fiber/Coaxial (HFC) System A broadband bidirectional shared-media transmission system using fiber trunks between the head-end and the fiber nodes, and coaxial distribution from the fiber nodes to the customer locations.

Hybrid Fiber/Coaxial (HFC) Network A network where the trunk of the cable plant is fiber technology. The fiber is connected to a coaxial cable and the signal is converted so that it is compatible to that media. The coaxial cable runs through the branches of the network and is dropped into the subscriber's home.

ICMP See Internet Control Message Protocol.

IEEE See Institute of Electrical and Electronic Engineers.

IETF See Internet Engineering Task Force.

IGMP See Internet Group Management Protocol.

Impulse Noise Noise characterized by non-overlapping transient disturbances.

Incremental Related Carriers (IRC)	A method of spacing NTSC television channels on a cable television system in which all channels except 5 and 6 correspond to the standard channel plan, used to reduce composite triple beat distortions.
Information Element	The fields that make up a MAP and define individual grants, deferred grants, etc.
Ingress Noise	A type of noise that is the major source of cable system noise. It is caused by discrete frequencies picked up by the cable plant from marine and radio broadcasts or from improperly grounded or shielded home appliances such as a hair dryer.
Initial Ranging	A process in which a cable modem acquires the correct timing offset so that it can accurately transmit using the correct mini-slot. Each cable modem obtains a timing offset; the timing offset depends on the time difference of the distance of the cable modem from the CMTS. Initial ranging is performed at cable modem initialization.
Institute of Electrical and Electronic Engineers (IEEE)	An organization of electrical engineers. The IEEE fosters the development of standards that often become national and international standards. Many IEEE standards are network interface standards.
International Organization for Standardization (ISO)	An international standards body, commonly known as the International Standards Organization.
International Telecommunicatio ns Union (ITU-T)	The Telecommunication Standardization Sector of the International Telecommunications Union is the primary international body for fostering cooperative standards for telecommunications equipment and systems.
Internet Control Message Protocol (ICMP)	An Internet network-layer protocol.
Internet Engineering Task Force (IETF)	A group that defines standard Internet operating protocol, such as TCP/IP.

Internet Group Management Protocol (IGMP) A network-layer protocol for managing multicast groups on the Internet. IGMP establishes and maintains a database of group multicast addresses and the interfaces to which a multicast router must forward the multicast data packets.

Internet Protocol (IP) The method or protocol by which data is sent from one computer to another on the Internet. Each computer (known as a host) on the Internet has at least one IP address that uniquely identifies it from all other computers on the Internet. An IP address includes a network address and a host address. An IP address can also be divided by using classless addressing or subnetting.

Interval Usage Code A field in MAPs and UCDs to link burst profiles to grants.

IP See Internet Protocol.

IP Filtering IP filtering enables you to filter upstream packets that pass through the CMTS. IP filtering can prevent subscribers from accessing head-end servers, enforce subscribers to log on to the cable network, enforce separately-billed service packages for data, and provide group access control for IP Multicast.

IP Multicast IP Multicast reduces traffic on a network by delivering a single stream of information to multiple users at one time.

IP Network A group of IP routers that route IP datagrams. These routers are sometimes referred to as Internet gateways. Users access the IP network from a host. Each network in the Internet includes some combination of hosts and IP routers.

IRC See Incremental Related Carriers.

ISO See International Organization for Standardization.

ITU-T See International Telecommunications Union.

Java A high level programming language developed by Sun Microsystems.

LAN See Local Area Network.

Latency The time delay, expressed in quantity of symbols, taken for a signal element to pass through a device.

Layer	A subdivision of the Open System Interconnection (OSI) architecture, constituted by subsystems of the same rank.
LDAP	See Lightweight Directory Access Protocol.
Lightweight Directory Access Protocol (LDAP)	A set of protocols for accessing information directories. LDAP is based on the standards contained within the X.500 standard, but is significantly simpler. And unlike X.500, LDAP supports TCP/IP, which is necessary for any type of Internet access to a directory server.
LLC	See Logical Link Control Procedure.
Local Area Network (LAN)	A non-public data network in which serial transmission is used for direct data communication among data stations located on the user's premises.
Logical Link Control (LLC) Procedure	In a local area network (LAN) or a Metropolitan Area Network (MAN), that part of the protocol that governs the assembling of data link layer frames and their exchange between data stations, independent of how the transmission medium is shared.
MAC	See Media Access Control.
Management Information Base (MIB)	A logical structure, used by the SNMP manager and agent, of the parameters needed for configuring, monitoring, or testing an SNMP device. The MIB is a hierarchical-naming structure used to uniquely identify SNMP objects (parameters). It is typically illustrated as an inverted tree.
Master Head-End	A head-end that collects television program material from various sources by satellite, microwave, fiber, and other means and distributes this material to Distribution Hubs in the same metropolitan or regional area. A Master Head-end MAY also perform the functions of a Distribution Hub for customers in its own immediate area.
Media Access Control (MAC) Address	A MAC address is used by the link layer protocol to forward packets "one hop at a time" between the host and the first router and between the first router and the next router and so on through the network until the packet arrives at it's final destination.
Media Access Control (MAC) Procedure	In a subnetwork, that part of the protocol that governs access to the transmission medium independent of the physical characteristics of the medium, but taking into account the topological aspects of the subnetworks, in order to enable the exchange of data between nodes. MAC

	procedures include framing, error protection, and acquiring the right to use the underlying transmission medium.
Media Access Control (MAC) Sublayer	The part of the data link layer that supports topology-dependent functions and uses the services of the Physical Layer to provide services to the logical link control (LLC) sublayer.
MIB	See Management Information Base.
Micro-reflections	Echoes in the forward transmission path due to departures from ideal amplitude and phase characteristics.
Mid Split	A frequency division scheme that allows bi-directional traffic on a single coaxial cable. Reverse channel signals propagate to the head-end from 5 to 108 MHz. Forward path signals go from the head-end from 162 MHz to the upper frequency limit. The diplex crossover band is located from 108 to 162 MHz.
Mini-Slot	A power-of-two multiple of 6.25 microsecond increments. For example, 1, 2, 4, 8, 16, 21, 64 or 128 times 6.25 microseconds. Mini-slots are used to divide the upstream bandwidth into discrete increments.
Moving Picture Experts Group (MPEG)	A group which develops standards for digital compressed moving pictures and associated audio.
MPEG	See Moving Picture Experts Group.
MSO	Multi System Operator
Multimedia Terminal Adapter (MTA)	A hardware interface between a computer and an Integrated Services Digital Network line needed for Voice Over IP.
Multipoint Access	User access in which more than one terminal equipment is supported by a single network termination.
Multipoint Connection	A connection among more than two data network terminations.

National Cable Television Association (NCTA)	A voluntary association of cable television operators which, among other things, provides guidance on measurements and objectives for cable television systems in the United States.
National Television Systems Committee (NTSC)	A committee which developed a set of standard protocol for television broadcast transmission and reception in the United States.
NCTA	See National Cable Television Association.
NEBS	See Network Equipment Building Systems.
Network Equipment Building Systems (NEBS)	NEBS is a Telcordia standard defining the physical, electrical, and environmental conditions under which network equipment must operate. NEBS includes: temperature, humidity, airborne contamination, fire resistance, earthquake and vibration, noise, electrical safety, lightning and surge immunity, ESD immunity, and electro-magnetic compatibility.
Network Layer	Layer 3 in the Open System Interconnection (OSI) architecture; the layer that establishes a path between open systems.
NS	Record that contains the domain name of the authoritative name server for the domain.
NTSC	See National Television Systems Committee.
Open Systems Interconnection (OSI)	A framework of ISO standards for communication between different systems made by different vendors, in which the communications process is organized into seven different categories that are placed in a layered sequence based on their relationship to the user. Each layer uses the layer immediately below it and provides a service to the layer above. Layers 7 through 4 deal with end-to-end communication between the message source and destination, and layers 3 through 1 deal with network functions.
Open Shortest Path First (OSPF)	An Interior Gateway Routing Protocol that use link-state algorithms to send routing information to all nodes in an OSPF area by calculating the shortest path to each node based on a map of the network constructed by each node. Each router sends that portion of the routing table (keeps track of routes to particular network destinations) that describes the state of its own links, and it also sends the complete routing structure of the network.
OSI	See Open Systems Interconnection.

OSPF	See Open Shortest Path First.
Packet Identifier (PID)	A unique integer value used to identify elementary streams of a program in a single- or multi-program MPEG-2 stream.
PHY	See Physical Layer.
Physical (PHY) Layer	Layer 1 in the Open System Interconnection (OSI) architecture. It provides services to transmit bits or groups of bits over a transmission link between open systems and which entails electrical, mechanical, and handshaking procedures.
Physical Media Dependent (PMD) Sublayer	A sublayer of the Physical Layer that transmits bits or groups of bits over particular types of transmission link between open systems. It entails electrical, mechanical, and handshaking procedures.
PID	See Packet Identifier.
PMD	See Physical Media Dependent Sublayer.
Protocol	A set of rules and formats that determines the communication behavior of layer entities in the performance of the layer functions. It may still require an authorization exchange with a policy module or external policy server prior to admission.
PTR	A record that contains a pointer to another part of the domain name space. This record is typically used in reverse zones.
QAM	See Quadrature Amplitude Modulation.
QoS	See Quality of Service.
Quadrature Amplitude Modulation (QAM)	A method of modulating digital signals onto a radio-frequency carrier signal involving both amplitude and phase coding. This achieves a higher data transfer rate than just amplitude or phase modulation alone.
Quality of Service	A networking term that specifies a guaranteed throughput level and end to end latency for traffic on the network.
Radio Frequency (RF)	Signals that are used by the CMTS transmitter and receiver to send data over HFC network. A radio frequency carrier is modulated to encode the digital data stream for transmission across the cable network.

Request For Comments (RFC)	A technical policy document of the IETF; these documents can be accessed on the World Wide Web at http://ds.internic.net/ds/rfcindex.html.
Return Loss	The parameter describing the attenuation of a guided wave signal (e.g., via a coaxial cable) returned to a source by a device or medium resulting from reflections of the signal generated by the source.
RF	See Radio Frequency.
RF DVT	Radio Frequency Design Verification Test.
RFC	See Request For Comments.
RIP	Routing Information Protocol.
Routing Information Protocol (RIP)	A routing protocol used for IP networks. The RIP protocol calculates the shortest distance between the source and destination address based on the lowest hop count.
Service Identifier (SID)	A mapping between the CM and the CMTS based on which bandwidth is allocated to the CM by the CMTS and by which COS is implemented. Within a MAC domain, all SIDs are unique.
SID	See Service Identifier.
Simple Network Management Protocol (SNMP)	A network management protocol used to monitor IP routers, other network devices, and the networks to which they attach.
SNAP	See Subnetwork Access Protocol.
SNMP	See Simple Network Management Protocol.
SOA	Start of Authority record. The purpose of the soa record is to inform other DNS servers how to treat information that the local server provides about the domain.
SOHO	Small Office Home Office
SSRAM	Synchronous Static RAM.

Subnet — A network subdivided into networks or subnets. When subnetting is used, the host portion of the IP address is divided into a subnet number and a host number. Hosts and routers identify the bits used for the network and subnet number through the use of a subnet mask.

Subnet Mask — A bit mask that is logically ANDed with the destination IP address of an IP packet to determine the network address. A router routes packets using the network address.

Subnetwork Access Protocol (SNAP) — An extension of the LLC header to accommodate the use of 802-type networks as IP networks.

Subscriber — A user in the home who accesses a data service.

Subsplit — A frequency-division scheme that allows bi-directional traffic on a single cable. Reverse path signals come to the head-end from 5 to 30 (up to 42 on Extended Subsplit systems) MHz. Forward path signals go from the head-end from 50 or 54 MHz to the upper frequency limit of the cable network.

TCP — See Transmission Control Protocol.

TFTP — See Trivial File-Transfer Protocol.

Tick — 6.25-microsecond time intervals that are the reference for upstream mini-slot definition and upstream transmission times.

Tilt — Maximum difference in transmission gain of a cable television system over a given bandwidth (typically the entire forward operating frequency range).instant at which the last bit of the same PDU crosses a second designated boundary.

TLV — See Type/Length/Value.

Transmission Control Protocol (TCP) — A reliable stream service which operates at the transport-layer Internet protocol which ensures successful end-to-end delivery of data packets without error.

Transmission Convergence Sublayer — A sublayer of the Physical Layer that provides an interface between the Data Link Layer and the PMD Sublayer.

Transmission Medium	The material on which information signals may be carried; e.g., optical fiber, coaxial cable, and twisted-wirepairs.
Transport Stream	In MPEG-2, a packet-based method of multiplexing one or more digital video and audio streams having one or more independent time bases into a single stream.
Trivial File-Transfer Protocol (TFTP)	An Internet protocol for transferring files without the requirement for user names and passwords that is typically used for automatic downloads of data and software.
Trunk Cable	Cables that carry the signal from the head-end to groups of subscribers. The cables can be either coaxial or fiber depending on the design of the system.
Type/Length/Value (TLV)	An encoding of three fields, in which the first field indicates the type of element, the second the length of the element, and the third field the value.
UCD	See Upstream Channel Descriptor.
UDP	See User Datagram Protocol.
UHF	See, Ultra-High Frequency.
Ultra-High Frequency	The range of the radio spectrum is the band extending from 300 MHz to 3 GHz. The wavelengths corresponding to these limit frequencies are 1 meter and 10 centimeters.
Upstream	The direction of the data flow from the subscriber location (CM) toward the head-end (CMTS).
Upstream Channel Descriptor (UCD)	A MAC management message transmitted by the CMTS Adapter Module at a configured period of time. A UCD defines the characteristics of an upstream channel including the size of the mini-slot, the upstream channel ID, and the downstream channel ID. It also defines channel parameters and a burst descriptor. UCDs are transmitted for each upstream channel.
User Datagram Protocol (UDP)	In conjunction with IP, UDP provides unreliable connection-less datagram delivery service. UDP can address specific protocol ports as a destination within a given host.

Very High Frequency (VHF) The range of the radio spectrum is the band extending from 30 MHz to 300 MHz. The wavelengths corresponding to these limit frequencies are 10 meters and 1 meter.

VGA Video Graphics Array display system.

VHF See Very High Frequency.

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